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ABSTRACT

This document describes the principles of the basic testing program of the Department of Defense Dependents Schools (DoDDS) and reports results in detail for the year 1978-79. Included are (1) the procedures used in developing the tests, (2) the statistical characteristics of the tests, (3) the methods employed in analyzing the findings, and (4) the curricular implications and recommendations based on these analyses. These documents were prepared for educators in the DoDDS system to serve as a basis for school level curricular review and development. Achievement test results are reported in detail in terms of educational objectives and subskills. A review of this document and its findings should assist in developing new instructional strategies to strengthen achievement within the basic skills in reading, language, and mathematics. (Author/CTM)

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Office of Dependents Schools

DEPARTMENT OF DEFENSE DEPENDENTS SCHOOLS
BASIC SKILLS ASSESSMENT TEST RESULTS

TECHNICAL REPORT

SPRING 1979

This report was prepared for the Department of Defense Overseas Dependents Schools by the Los Angeles County Test Development Center under contract MDS-903-79-C-0020.

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INTRODUCTION

Described herein are the underlying principles of the Department of Defense Dependents Schools (DoDDS) Basic Testing Program conducted during the fiscal year 1978-79. Discussed here in are the procedures used to develop the tests, their statistical characteristics, methods used to analyze the findings, and the conclusions resulting from analyses.

This document should serve two audiences directly, and a third indirectly:

- A professional technical audience will be interested in measurement theory and application, particularly in relation to the Rasch model, as well as in traditional concerns related to validity and reliability.
- A professional nontechnical audience will be interested in the pedagogical conclusions to be drawn from the findings, both from an instructional point of view and from a management perspective.
- A lay audience will be interested in the implications of the data in relation to individual pupil performance and program effectiveness.

This document has been prepared for educators in the dependents schools system. It should serve as a basis for curriculum review and development. The test results reported herein should help focus upon student achievement and the ways in which it verifies or challenges assumptions about the basic skills competencies of pupils in the overseas dependents schools. New programs and teaching strategies to strengthen pupil achievements in the DoDDS system should grow from a review of this document and its findings.

RATIONALE FOR USING THE RASCH MODEL

Traditional group testing procedures offer only incomplete solutions to the complex measurement problems associated with achievement assessment. In the past, the interpretation of a student's score has depended on some external reference group, or on a unique set of items, or both. Norm-referenced tests, even with items matched to specific objectives, let each item contribute equally to the total score. They make no provision for assessing skills of varying difficulty or importance. Only the absolute number of correct responses, not which items are missed, affects the total score and its interpretation. Criterion-referenced tests with specific items matched to skills or objectives also do not solve these complex problems. The questions of differential skill importance and mastery identification, both within and across skills, remain unanswered for each content area. Also criterion-referenced tests do not solve the problem of a test score being dependent on a unique set of items for interpretation.

What has been needed is a measurement system to provide an assessment of a student's ability which can be interpreted without referring to a specific set of students or a unique set of items. Also needed has been a system where the skills of the items assessed are arranged in a hierarchical continuum of difficulty.

RATIONALE FOR USING THE RASCH MODEL (contd.)

The Rasch model offers such a system. It states that one can calibrate a collection of items measuring different skills within a content area into a difficulty continuum which remains stable across various sub-groups of test-takers or subsets of items. The scores derived from administering a subset of items from the calibrated item bank are related only to individual student ability, not to the performance of an external group. The Rasch model and continuums also allow one to identify mastery with respect to all skills assessed by bank items, within defined probability limits. Under this scaling procedure, the achievement level one subset of items indicates is similar to that indicated by a different subset. This system can also provide normative information relating to any identifiable group of test-takers.

DEVELOPMENT OF THE RASCH-CALIBRATED ITEM BANKS

Described below is the five-step process used to develop the Rasch-calibrated item banks in the three content areas of reading, language arts, and mathematics.

The first step in developing each item bank was the collecting of a large number of items. Sources used in this process included the National Assessment of Educational Progress; the Institute for Educational Research; St. Bernard Parish; California State Department of Education; Alaska State Department of Education; Northwest Regional Educational Laboratory; Board of Education—Chalmette, Louisiana; and Offices of the Los Angeles County and Fresno County Superintendents of Schools. The sole criterion for including an item in this initial collection was that it be relevant in some way to any of the three defined content areas. No attempt was made at first to judge item quality. Experts reviewed the psychometric properties and curriculum validity of the items in a later step, as noted below.

Concurrent with and following the acquisition of the initial pool of 2,500 items, work began to develop an item classification system for each content area. These classification systems were necessary to provide both a method of determining the extent of the proposed item banks' coverage and a system for reaching items dealing with a specific skill within the banks. Curriculum specialists within each content area (including teachers and curriculum directors) undertook this task. These specialists first reviewed existing systems to see how useful they were. Since none was satisfactory for item bank classification, they developed a unique system for each content area. After developing these systems, they established item review and classification procedures. This process required the services of curriculum and measurement specialists, who reviewed each item for its psychometric properties and its curriculum validity.

If an item was judged satisfactory with regard to the criteria within each part of the review process, it received a classification number. This number identified the specific skill assessed by the item and also provided a unique acquisition number. If an item fell outside the classification system but curriculum specialists decided it assessed a desirable skill, it was retained and the skill added to the classification system. The curriculum specialists also assigned a grade level to each item, based on their estimate that about

60% of the students at that grade level could answer it correctly. Using this grade-level assignment, the items within a content area were ordered by difficulty, from "easy" to "hard." This ordering would be used in a later step, when forms were given to students during the calibration process.

The third major step in developing each calibrated item bank was assigning items to test forms. This was necessary, since no student or group of students could be expected to respond to all items within a content area. All forms within each content area were linked together by pairs of common items. This linking structure formed a net-like pattern which allowed all items to be subsequently calibrated onto a common scale. Any individual student would take only a single form of about 30 items appropriate to his/her ability level.

The linking process was accomplished by using a computer program developed specifically for the task. To control the difficulty range within any one form, this program ran several times, varying the number of items per link. The number of items per form was limited to a maximum of thirty. Based on analysis of the computer runs' results, the math forms used three items per link; the other two content areas had one item per link. In the area of reading, where items were dependent upon a specific reading passage, that passage--not an individual item--became the link. Because it seemed desirable also to have items which were not passage-dependent, another subset was created. There was a 30% overlap of items between the two subsets, as the final bank was to contain both types of reading items. Through this overlap, it was possible to calibrate all items onto a common scale in the area of reading.

The fourth major step in the development required administering the forms to students. Although 200 valid responses provide a stable item calibration, at least 600 students received each form. This was done because little information was available regarding the students' ability except their current grade level. Under these conditions, some students may have been assigned forms either too hard or too easy, giving no useful information in either case. This information loss, however, was not serious because of the large number of students assigned any one form, which assured that each item achieved the 200 minimum.

Students involved in the calibration process ranged from Grades 3 to 12. They were drawn from all areas of the United States, including Hawaii, Ohio, Louisiana, and California. The sample included the principal ethnic minority groups (Black, Mexican-American, Asian-American, and American Indian). Twenty DoDDS schools participated in the calibration. Various ability groups, including mentally gifted minors and the educationally handicapped or learning disabled, were also part of the overall calibration sample. Altogether, some 50,000 students received calibration forms. In most cases (over 85%), each student took a form within each content area. This was desirable in order subsequently to look at student performance across content areas. Testing took place in the fall, 1978.

The fifth major step in developing each item bank was the actual item calibration. Before the calibration process, machine-readable answer sheets were

DEVELOPMENT OF THE RASCH-CALIBRATED ITEM BANKS (contd.)

electronically scanned and transferred to magnetic tape. This tape was subjected to a specific program designed to clean out all invalid answer sheets. This clean student-response tape was then read into the calibration programs. The process required two programs—FORCAL, which calibrated items within forms, and PARCAL, which did so across forms. Before calibration, FORCAL identified both inappropriate students and inappropriate items, using two different goodness-of-fit criteria. Student responses were eliminated if forms were assigned inappropriately or if either guessing or random answering occurred. Items were discarded if their response curve did not fit the Rasch model because of some bias in the item, ambiguity, or miskeying. All decisions about deleting items or students from the calibration process were made using goodness-of-fit statistical procedures.

The second program, PARCAL, using item calibration values determined by FORCAL, provided the item calibrations across forms within a content area. This program determined these values by considering all two-item sets across all forms. After all items within a content area were calibrated and tested for goodness-of-fit, a rank order continuum based on the items' calibrated values was developed. After this ordering and the identification of multiple items having similar values, curriculum specialists attached content descriptors to subsets of items measuring the same skill. These descriptors, along with the corresponding item values, were then placed together to form the calibrated skills continuum needed for reports for individuals and groups of students.

Those DoDDS schools participating in the calibration process received an individual student report for each student listed in each subject area, a list of school means, and the mean score for each grade and subject tested for the entire calibration sample. The Interpretative Guide for the Fall 1978 Calibrated Tests and A Glossary to the Abbreviated Skill Descriptors Used in Student Reports, which explain the student report and the terms used in it, were also provided.

SCOPE OF RESPONSIBLITY

The DoDDS Basic Testing Program employed the TDC's services to begin using the Rasch measurement model during fiscal year 1978-79. The TDC developed separate tests for pupils in the subject areas of reading and language arts in Grades 9 and 11, and one in math used by both Grades 7 and 11.

DEVELOPMENT OF THE DoDDS TEST

During the winter of 1978-79, the TDC staff worked with DoDDS measurement and curriculum personnel to choose areas to be tested. DoDDS staff identified the major skill and subskill areas necessary; these were drawn from the available DoDDS curriculum guides.

Members of the TDC staff then selected test items to be included in the tests. By design, they offered more items than could be used to the DoDDS staff for its final choices. DoDDS curriculum staff made the final

DEVELOPMENT OF THE RASCH-CALIBRATED ITEM BANKS (contd.)

selection of each item and signed off on the content of the tests in January, 1979. There were two separate forms constructed for reading and language arts—Grades 9 and 11—and one form for mathematics, covering both Grades 7 and 11.

Reading Comprehension

The 9th grade Reading Comprehension test is a 22-item form ranging in item difficulty from 449 to 665, with a mean difficulty of 546. The 11th grade Reading Comprehension test is a 17-item form ranging in item difficulty from 456 to 698, with a mean difficulty of 540. Tables 1 and 2 list the skill area measured by each item for the reading tests and the items' difficulty.

Language Arts

The Language Arts 9th grade test is a 29-item form ranging in item difficulty from 424 to 630. The mean item difficulty level in this test is 529. The Language Arts 11th grade test is a 27-item form, ranging in item difficulty from 413 to 662. Its mean difficulty level is 547. Tables 3 and 4 list the skill areas and item difficulties.

Mathmematical Computation

The math test is a 40-item form, ranging in item difficulty from 294 to 691. The mean difficulty level is 490. Table 5 lists the skill areas and item difficulties.

TEST ADMINISTRATION AND DISTRIBUTION OF MATERIALS

Test materials (including test booklets, answer sheets, and manuals) were mailed to 260 school sites in the Atlantic, European, and Pacific regions. Students were tested in Grades 7 (mathematics only), 9 (reading and language arts), and 11 (all three areas). Table 6 shows the number of test booklets and answer sheets shipped.

Each school site received a set of test booklets, teacher identification sheets, answer sheets, return-receipt postcards, return envelopes, and a packing slip. Each site was also given a Test Coordinator's Manual and an Examiner's Manual. The Test Coordinator's Manual outlined general procedures for instructing school site personnel on test administration: testing cautions, dealing with guessing, handling test materials, school identification sheets, and control cards. The Examiner's Manual gave instructions on required materials, passing out test booklets, verbatim instructions to students, and collecting test materials.

TABLE 1

BASIC SKILLS ASSESSMENT TEST

READING COMPREHENSION
GRADE 9

ITEM POSITION	**ITEM DIFFICULTY	SKILL DESCRIPTOR
*1	500	STUDY SKILLS - Use of Reference Materials
2	482	EVALUATIVE COMPREHENSION - Identify Author's Purpose
3	449	INTERPRETIVE COMPREHENSION - Identify Mood/Tone
4	469	EVALUATIVE COMPREHENSION - Judge Validity of Conclusion
5	505	STUDY SKILLS - Interpret Maps and Diagrams
6	548	LITERAL COMPREHENSION - Sequence
7	510	LITERAL COMPREHENSION - Details
8	531	INTERPRETIVE COMPREHENSION - Main Idea
9	563	STUDY SKILLS - Use of Reference Materials
10	585	STUDY SKILLS - Use of Encyclopedia
11	569	EVALUATIVE COMPREHENSION - Distinguish Fantasy and Realism
12	535	INTERPRETIVE COMPREHENSION - Cause and Effect
13	548	VOCABULARY - Contextual Meaning
14	561	EVALUATIVE COMPREHENSION - Recognize Details
15	635	VOCABULARY - Contextual Meaning
16	564	STUDY SKILLS - Meaning Appropriate to Content
17	583	EVALUATIVE COMPREHENSION - Predictive Outcomes
*18	611	EVALUATIVE COMPREHENSION - Compare, Generalize, Summarize
19	523	VOCABULARY - Punctuation
*20	631	EVALUATIVE COMPREHENSION - Styles, Techniques, and Forms
21	545	EVALUATIVE COMPREHENSION - Identify Author's Authority
22	665	LITERAL COMPREHENSION - Sequence

* Deleted for failure to meet Rasch measurement criteria
** Rasch-calibrated item difficulty on reading scale

TABLE 2

BASIC SKILLS ASSESSMENT TEST

READING COMPREHENSION
GRADE 11

ITEM POSITION	**ITEM DIFFICULTY	SKILL DESCRIPTOR
1	487	VOCABULARY - Contextual Meaning
2	456	STUDY SKILLS - Interpret Maps and Diagrams
3	487	STUDY - Location Skills - Index
4	576	EVALUATIVE COMPREHENSION - Distinguish Fantasy and Realism
5	543	STUDY SKILLS - Use of Encyclopedia
6	476	STUDY SKILLS - Use of Reference Materials
7	525	EVALUATIVE COMPREHENSION - Compare, Generalize, Summarize
*8	489	LITERAL COMPREHENSION - Details
*9	698	LITERAL COMPREHENSION - Sequence
10	536	INTERPRETIVE INFERENTIAL - Subordinate Detail
11	575	INTERPRETIVE COMPREHENSION - Identify Mood/Tone
12	548	EVALUATIVE COMPREHENSION - Recognize Assumptions
13	594	STUDY - Skills Meaning Appropriate to Content
14	500	EVALUATIVE COMPREHENSION - Identify Author's Authority
15	616	EVALUATIVE COMPREHENSION - Judge Validity of Conclusion
16	639	EVALUATIVE COMPREHENSION - Predictive Outcomes
*17	681	VOCABULARY WORD IDENTIFICATION CLUES - Punctuation

* Deleted for failure to meet Rasch measurement criteria
** Rasch-calibrated item difficulty on reading scale

TABLE 3

BASIC SKILLS ASSESSMENT TEST

LANGUAGE ARTS
GRADE 9

ITEM POSITION	**ITEM DIFFICULTY	SKILL DESCRIPTOR
1	424	USAGE - Subject-Verb Agreement
2	445	BUILDING AND CHANGING SENTENCE - Subordination
3	452	SPELLING - Suffixes That Form Plurals
4	474	BUILDING AND CHANGING SENTENCE - Passive/Active
5	476	SPELLING - Frequently Misspelled Word Due to Mispronunciation
6	480	BUILDING AND CHANGING SENTENCE - Coordination
7	485	SPELLING - Word With Long Vowel in Middle of Syllable
8	546	PARAGRAPH DEVELOPMENT - Paragraph Transition
9	493	PARAGRAPH DEVELOPMENT - Closing Statement
10	515	SPELLING - Word with Short Vowel in Middle of Syllable
11	501	USAGE - Verb Tense
12	523	SPELLING - Suffix That Forms Adjective From Noun and Verb
13	523	PUNCTUATION - Quotation Marks
14	461	USAGE - Double Negatives
15	528	PUNCTUATION - Apostrophes
16	535	SPELLING - Consonant Building More Than One Syllable
17	619	PUNCTUATION - Semicolons
18	537	PARAGRAPH DEVELOPMENT - Topic Sentence
19	516	USAGE - Comparatives and Superlatives
20	546	SENTENCE TYPES - Declarative
21	629	USAGE - Comparatives and Superlatives
22	553	CAPITALIZATION - Proper Nouns
23	553	LANGUAGE CHOICE - Word Connotation and Denotation
24	576	SENTENCE STRUCTURE - Direct Object
25	502	IMAGINATIVE/NARRATIVE DISCOURSE - Short Story
26	591	BUILDING AND CHANGING SENTENCE - Embedding (Appositive)
*27	609	SENTENCE TYPE - Complex
28	612	SENTENCE STRUCTURE - Noun Clauses
29	630	SENTENCE STRUCTURE - Adjective Clauses

* Deleted for failure to meet Rasch measurement criteria
** Rasch-calibrated item difficulty on language scale

TABLE 4

BASIC SKILLS ASSESSMENT TEST

LANGUAGE ARTS
GRADE 11

ITEM POSITION	**ITEM DIFFICULTY	SKILL DESCRIPTOR
1	413	SPELLING - Word with Short Vowel in Middle of Syllable
2	501	SPELLING - Word with Long Vowel in Middle of Syllable
3	476	SPELLING - Frequently Misspelled Word Due to Mispronunciation
4	503	USAGE - Verb Tense
5	510	PARAGRAPH DEVELOPMENT - Topic Sentence
6	512	PUNCTUATION - Quotation Marks
7	526	CAPITALIZATION - Proper Nouns
8	525	USAGE - Double Negatives
9	530	BUILDING AND CHANGING SENTENCE - Compounding
10	593	USAGE - Comparatives and Superlatives
11	545	BUILDING AND CHANGING SENTENCE - Passive/Active
12	464	PARAGRAPH DEVELOPMENT - Paragraph Transition
*13	556	SENTENCE TYPES - Complex
14	613	PUNCTUATION - Semicolons
15	561	SENTENCE TYPES - Declarative
16	565	LANGUAGE CHOICE - Word Connotation and Denotation
17	470	IMAGINATIVE/NARRATIVE DISCOURSE - Short Story
18	577	SENTENCE STRUCTURE - Objective/Complement - Object of Preposition
19	578	USAGE - Subject-Verb Agreement
20	585	PARAGRAPH DEVELOPMENT - Closing Statement
21	588	BUILDING AND CHANGING SENTENCE - Embedding (Appositive)
22	606	WORD CHOICE (Idiom, Trite Expression, Poor Construction)
23	500	ANALYTICAL/EXPOSITORY - Editorial
24	592	SENTENCE STRUCTURE - Adverb Clause
25	595	BUILDING AND CHANGING SENTENCE - Subordination
26	622	SENTENCE STRUCTURE - Adjective Clause
27	662	BUILDING AND CHANGING SENTENCE - Coordination

* Deleted for failure to meet Rasch measurement criteria
** Rasch-calibrated item difficulty on language scale

TABLE 5

BASIC SKILLS ASSESSMENT TEST

MATHEMATICS
GRADES 7 AND 11

ITEM POSITION	**ITEM DIFFICULTY	SKILL DESCRIPTOR
1	294	Add Multidigit Integers Without Regrouping
2	353	Subtract Multidigit Integers Without Regrouping
3	411	Add Multidigit Integers With Regrouping
4	364	Add Multidigit Integers With Regrouping
5	438	Subtract Celsius Temperature
6	420	Multiply 2 to 3 Digits by 2 Digits with Regrouping
7	448	Subtract Fahrenheit Temperature
8	429	Application Add Decimals - Not Aligned
9	429	Divide Multidigit by Single Digit With Remainder
10	431	Application Add Integers With Regrouping (Chart)
11	432	Multiply 2 to 3 Digits by 2 Digits With Regrouping
12	436	Subtract Multidigit Integers With Regrouping
13	439	Multiply 2 to 3 Digits by 2 Digits Without Regrouping
14	447	Add Decimals - Points Aligned
15	464	Divide Multidigit by Single Digit Without Remainder
16	467	Divide Multidigit by Single Digit With Remainder
17	480	Add Multidigit Integers With Regrouping - Not Aligned
18	482	Application Mixed Operation With Money: Add - Divide (Chart)
19	492	Multiply 2 to 3 Digits by 2 Digits Without Regrouping
20	445	Plane Metric Linear Measurement
21	498	Evaluate Simple Algebraic Expressions With Combined Operations
22	573	Application Add English Weight Renaming
23	597	Cubic Metric Measurement
24	515	Application Plane English Square Measurement
25	516	Application Subtract Decimals With Regrouping - Not Aligned
26	576	Mixed Operations With Time: Averages
27	628	Application Money Multiply 3 by 2 Digits With Regrouping
28	603	Multiply English Weight Renaming
29	519	Application Division Decimals
30	584	Convert Percent to Decimal
31	512	Application Divide English Weight
32	525	Application Subtract Fractions
33	516	Application Add Fahrenheit Temperature
34	541	Add Mixed Fractions With Unlike Denominators
35	544	Add Mixed Fractions With Unlike Denominators
36	455	Application Plane Metric Linear Measurement
37	588	Application Plane English Linear Measurement
38	500	Add Simple Algebraic Expressions
39	513	Application Mixed Operations With Decimals - Not Aligned - Temperature Averages
40	691	Application Plane Metric Square Measurement

** Rasch-calibrated item difficulty on mathematics scale

TABLE 6

TEST BOOKLETS AND ANSWER SHEETS
MAILED AND RECEIVED

Grade Level		CONTENT AREA		
		Reading	Language Arts	Mathematics
7	Mailed	*	*	11,000
	Received			7,661
9	Mailed	11,000	11,000	*
	Received	6,448	6,375	
11	Mailed	10,000	10,000	10,000
	Received	3,441	3,704	4,318

TEST ADMINISTRATION AND DISTRIBUTION OF MATERIALS (contd.)

Materials Collection

Examiners were instructed to administer and collect all testing materials by May 15, 1979; they then sent these materials to the school site coordinator. The school site coordinator forwarded completed answer sheets to the Test Development Center in Downey, California, and returned the test booklets to DoDDS regional headquarters.

Data Processing

A cutoff date of July 7 was set for receipt of answer sheets, to ensure meeting the final deadline date. The number of answer sheets received was significantly less than expected (Table 6). Upon receipt of each school's answer sheets, the TDC edited each sheet for stray marks, incomplete erasures, and other irregularities which might interfere with reporting accurate results. The sheets were then electronically scanned and the images transferred to tape. The data on the tape were again edited for completeness, accuracy of school codes, appropriate marking of content areas, and completeness of the scanning procedure.

The next major procedure was a FORCAL routine that generated item, form, and student fit statistics, as described above. Items failing to meet the appropriate biserial and fit levels were deleted from the form. Tables 1-5 show which items had to be deleted.

DoDDS TESTING PROGRAM REPORTS

After the student answer sheets were scanned and scored, the results gave rise to reports which were returned to school sites and the program evaluation staff. The reports sent to each school site were as follows:

1. An individual student report for each subject tested.
2. Student rosters for each subject.
3. School average score for each subject and grade tested.

The Coordinator of Research and Program Evaluation received reports of the school average scores by subject and grade and the overall average score, also by subject and grade.

In addition, the following interpretative materials were furnished to school principals and regional directors:

1. Skills Continuums (preliminary edition) in Mathematical Computation, Reading Comprehension, and Written Expression.
2. Interpretative Guide to the Student Report and Student Roster.
3. Interpretative Guide to the District and School Statistical Reports.
4. Content Classification Systems in Mathematics, Written Expression and Reading Comprehension.

DoDDS TESTING PROGRAM REPORTS (contd.)

A cassette tape-filmstrip program explaining the model used for the Basic Skills Assessment tests and the use of the Student Report and Skills Continuums was also developed and sent to each school site.

ANALYSIS OF RESULTS

This section of the Technical Report contains descriptive statistics, the Equating Study, Demographic Analysis, and Curricular Findings and Implications resulting from the Basic Skills Assessment.

DESCRIPTIVE STATISTICS

Table 7 presents means, standard deviations, and frequencies for the various grade and content levels covered in the assessment program. As expected, group mean performance increased as the grade level of the student tested increased. Also, within-group variance increased across grade levels indicating increased variability with respect to the ability to perform basic skills in the content areas of reading, language arts, and mathematics. (Item analysis and cumulative frequencies for each grade and content area are found in Appendices 1 and 2. National means derived from the initial calibration process are found in Appendix 3.)

TABLE 7

MEANS AND STANDARD DEVIATIONS
FOR BASIC SKILLS ASSESSMENT TESTS

	GRADE LEVEL		
Content Area	7	9	11
Reading			
M	*	600	626
SD	*	41	46
N	*	6,448	3,441
Language Arts			
M	*	577	590
SD	*	39	49
N	*	6,376	3,704
Mathematics			
M	530	*	574
SD	45	*	49
N	7,661	*	4,318

* Not tested at this grade level

EQUATING STUDY

Since part of the scope of the contract between DoDDS and the TTC required the equating of student performance on the Basic Skills Assessment Test to a nationally normed achievement test, Dr. Ronald Hambleton of the University of Massachusetts was employed as a technical consultant for this phase of the work. Based on the procedure suggested by Dr. Hambleton, a small pilot study was designed and conducted to determine the feasibility of using a linear regression model for this equating process.

This preliminary study used scores obtained on the Comprehensive Test of Basic Skills, Form S, Level 3 (CTBS-S) as the dependent variable and the Rasch Measure devised from performance on a set of items drawn from a calibrated item bank as the independent variable.

Based on the analysis of 234 pairs of seventh grade student scores, regression equations were developed for each of the content areas of reading, language arts, and mathematics. These equations along with the appropriate standard error of estimate are presented in Table 8. All correlations were significant beyond the .001 level.

Tables 9, 10, and 11 show the predicted CTBS-S scale score and grade equivalent corresponding to the mean performance and to one standard deviation above and below the mean on the Basic Skills Assessment Test for grades 7 and 11 in mathematics and grades 9 and 11 in reading and language arts.

These conversions were taken from the CTBS-S Expanded Standard Score (Scale Score) to Grade Equivalent Table in the Examiner's Manual. For this preliminary study, predicted scores for 9th and 11th grade students were developed from the 7th grade students' scores used in this pilot study. This procedure was determined to be tentatively valid since raw scores on the CTBS-S for all levels have been placed on the same scale using a single conversion table. However, caution should be used in interpreting these results pending the completion of the more comprehensive study outlined below.

Preliminary findings appear to indicate that the mean performance of DoDDS students, for the grade levels and content areas tested, would be at a slightly above grade level if tested on a nationally normed standardized achievement test.

A more definitive analysis will be conducted at the end of the second year of the testing program using a much larger sample across multiple grade and ability levels. The design of such a study has been completed and arrangements have been made to gather data from students in elementary, junior, and senior high schools. It is anticipated that a minimum of 8,000 students will be tested on both the CTBS-S and on tests composed of items drawn from calibrated item banks. A sample of such magnitude will provide for the opportunity to carry out regression analysis using cross-validation procedures. The results of this equating study will be presented in detail in the technical report for the second year of the current testing program.

TABLE 8

LINEAR REGRESSIONS BETWEEN
THE BASIC SKILLS ASSESSMENT TEST AND THE
COMPREHENSIVE TESTS OF BASIC SKILLS
LEVEL 3, FORM S BY SUBJECT AREA

	READING	LANGUAGE ARTS	MATHEMATICS
r	.77	.73	.76
N	232	233	234
Sy.x	53	53	48
Intercept (a)	-257	-156	-81
Slope (b)	1.39	1.22	1.06

TABLE 9

PREDICTED SCALED SCORES AND
GRADE EQUIVALENTS ON THE CTBS-S FOR LANGUAGE ARTS

GRADES 9 AND 11

Grade 9			Grade 11		
BSAT Measure	CTBS Scale Score	CTBS GE	BSAT Measure	CTBS Scale Score	CTBS GE
538[a]	500	7.3	541[a]	504	7.6
577[b]	547	9.7	590[b]	563	10.1
616[c]	632	11.0	639[c]	623	12.3

a = 1 S.D. below mean
b = mean
c = 1 S.D. above mean

TABLE 10

PREDICTED SCALED SCORES AND
GRADE EQUIVALENTS ON THE CTBS-S FOR READING

GRADES 9 AND 11

Grade 9			Grade 11		
BSAT Measure	CTBS Scale Score	CTBS GE	BSAT Measure	CTBS Scale Score	CTBS GE
560[a]	521	7.9	580[a]	549	8.8
600[b]	577	9.8	626[b]	613	10.7
640[c]	561	11.3	672[c]	677	12.9

a = 1 S.D. below mean
b = mean
c = 1 S.D. above mean

TABLE 11

PREDICTED SCALED SCORES AND
GRADE EQUIVALENTS ON THE CTBS-U FOR MATHEMATICS

GRADES 7 AND 11

Grade 7			Grade 11		
BSAT Measure	CTBS Scale Score	CTBS GE	BSAT Measure	CTBS Scale Score	CTBS GE
485[a]	433	5.6	524[a]	474	6.9
530[b]	480	7.1	574[b]	527	8.9
575[c]	528	8.9	624[c]	580	10.3

a = 1 S.D. below mean
b = mean
c = 1 S.D. above mean

21

DEMOGRAPHIC ANALYSIS

Chi Square analysis was used to determine whether a significant relationship existed between the length of time that a student had attended a DoDDS school and his scores on the achievement test. For the purposes of this analysis, scores on the achievement measures within the three content areas were broken into four categories: at or below one standard deviation from the mean, the mean to one standard deviation below, the mean to one standard deviation above, and at or above one standard deviation from the mean.

Tables 12 and 13 present the chi square analysis for this relationship relating to the content area of mathematics for grades 7 and 11. In both cases, the relationship was found to be statistically significant ($P < .05$) but of little educational significance since only slight changes occur in the row percentages.

Table 14 presents the chi square analysis for grade 9 students relative to the content area of language arts. This relationship was also statistically significant ($P < .05$) but of no educational significance. No analysis was possible for 11th grade students due to the extreme skewness of the distribution of test scores.

Table 15 presents the chi square analysis for grade 9 students relative to the content area of reading. The relationship was again statistically significant ($P < .05$) but of no educational importance. No analysis was possible for 11th grade students. This was again due to extreme skewness of the distribution.

It was not possible to compute additional chi square analyses on the remaining two demographic variables due to an uneven distribution of student responses. In both cases, that of primary home languages and that of language spoken at home prior to entering school, English was chosen by the majority of students.

TABLE 12

CHI SQUARE ANALYSIS FOR THE RELATIONSHIP
BETWEEN MATH ACHIEVEMENT AND
THE LENGTH OF TIME IN DoDDS SCHOOLS
FOR GRADE 7 STUDENTS

"Altogether, how long have you attended the Overseas Dependents Schools?"

Math Scores	Less Than One Year	1 to 2 Years	3 or More Years	Don't Know
-1 S.D.	192 16%	333 27%	677 55%	20 2%
$\bar{X}$ to -1 S.D.	340 15%	635 29%	1184 54%	47 2%
$\bar{X}$ to 1 S.D.	472 16%	816 28%	1502 51%	163 5%
+1 S.D.	189 18%	317 30%	446 43%	91 9%

Chi Square = 128.97

$P < .05$

26

TABLE 13

CHI SQUARE ANALYSIS FOR THE RELATIONSHIP
BETWEEN MATH ACHIEVEMENT AND
THE LENGTH OF TIME IN DoDDS SCHOOLS
FOR GRADE 11 STUDENTS

"Altogether, how long have you attended the Overseas Dependents Schools?"

Math Scores	Less Than One Year	1 to 2 Years	3 or More Years	Don't Know
-1 S.D.	104 14%	171 24%	434 61%	3 1%
$\bar{X}$ to -1 S.D.	192 15%	290 23%	761 61%	17 1%
$\bar{X}$ to 1 S.D.	156 12%	286 23%	819 64%	16 1%
+ 1 S.D.	94 14%	167 26%	371 58%	13 2%

Chi Square = 17.39

$P < .05$

TABLE 14

CHI SQUARE ANALYSIS FOR THE RELATIONSHIP
BETWEEN LANGUAGE ARTS ACHIEVEMENT AND
THE LENGTH OF TIME IN DoDDS SCHOOLS
FOR GRADE 9 STUDENTS

"Altogether, how long have you attended the Overseas Dependents Schools?"

Math Scores	Less Than One Year	1 to 2 Years	3 or More Years	Don't Know
-1 S.D.	163 19%	197 23%	496 57%	6 1%
$\bar{X}$ to -1 S.D.	354 13%	701 26%	1583 59%	35 2%
$\bar{X}$ to 1 S.D.	322 15%	557 26%	1221 57%	43 2%
+ 1 S.D.	145 18%	223 27%	417 51%	32 4%

Chi Square = 59.78

$P < .05$

23

TABLE 15

CHI SQUARE ANALYSIS FOR THE RELATIONSHIP
BETWEEN READING ACHIEVEMENT AND
THE LENGTH OF TIME IN DoDDS SCHOOLS
FOR GRADE 9 STUDENTS

"Altogether, how long have you attended the Overseas Dependents Schools?"

Math Scores	Less Than One Year	1 to 2 Years	3 or More Years	Don't Know
-1 S.D.	220 15%	384 27%	830 57%	15 1%
$\bar{X}$ to -1 S.D.	366 15%	639 26%	1414 58%	29 1%
$\bar{X}$ to 1 S.D.	304 14%	527 25%	1236 59%	47 2%
+1 S.D.	172 18%	267 27%	504 52%	30 3%

Chi Square = 33.90

P < .05

PERFORMANCE SUMMARY AND CURRICULUM IMPLICATIONS FOR READING

INTRODUCTION

The purpose of this section of the technical report is to provide a curricular interpretation of reading performance data for grades 9 and 11.

To examine student performance in relation to a total curricular sequence, the DoDDS Scope and Sequence Curricular Skills Guide was placed on the Rasch measurement scale. Eight broad categories or domains of reading skills were identified by DoDDS as critical for reading development. These eight domains are listed below:

1. Development of Sight Vocabulary
2. Structural Analysis
3. Comprehension of Factual Information
4. Comprehension of Critical Information
5. Comprehension of Critically Read Material
6. Use of Visual Reference Materials
7. Organization of Reading Material for Study
8. Appreciation of Literature in Many Genres

Each domain contains subskills, each of which has a range of difficulty which has been graphically displayed in Figure 1.

To examine student performance in relation to the difficulty ranges of subkills within each domain, the mean scores for DoDDS ninth and eleventh grade students, 600 and 626 respectively, were placed vertically on this continuum of DoDDS reading skills.

FINDINGS

Student performance for all ninth and eleventh graders are reported in terms of group percentages and standard deviations around the mean. Findings of these analyses are summarized in Tables 16 and 17.

DoDDS Normal Expectancy represents 1 S.D. around the mean (1/2 S.D. above and 1/2 S.D. below) and is expressed in terms of score range in relation to the DoDDS Scope and Sequence of Reading Skills.

Because some reading subskills have an upper range of difficulty that extends beyond the "normal" range (as defined above), performance at this level is considered optimal or Above DoDDS Normal Expectancy for students as defined by DoDDS Scope and Sequence Curricular Skills Guide.

Conversely, score ranges falling Below DoDDS Normal Expectancy are represented by those skills that show a difficulty range of 1/2 S.D. or more below the mean. This group could be further subdivided into remedial and marginal skill performance.

The findings for each grade level will be presented separately along with instructional recommendations.

TABLE 16
READING
SKILL LEVELS
FOR GRADE 9 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	396-576	577-622	623-679
Implications	Students have 7th grade reading skills or below. Continued work in Study Skills, interpretive analysis and vocabulary development Intensive remediation efforts indicated for student measures below 533.	Students in this score range are on grade level and approaching optimal development of most skill areas.	Advanced work suggested for this high ability group. - vocabulary development - abstractions - evaluative analysis - characterization and motives
Percent of DoDDS Students in Score Range	1396 = 21.7%	3742 = 58.0%	1310 = 20.3%

$\bar{X}$ = 600
N = 6,448

TABLE 17
READING
SKILL LEVELS
FOR GRADE 11 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	580 and Below	581-649	650-679
Implications	Remediation desirable - Suggested instructional level - grade 7 Emphasis placed on interpreting information.	Normal range for grade 11. Continued work in Study Skills desirable and summarizing information.	Mastery of most reading skills. Advanced instruction at evaluative levels of thinking and contextual vocabulary development would continue optimal growth of reading skills. Challenge with abstractions, imagery, and creative thinking. Stress vocabulary development for SAT and college entrance exams.
Percent of DoDDS Students in Score Range	523 = 15.2%	1618 = 47.0%	1300 = 37.8%

$\bar{X}$ = 626
N = 3,441

DODDS SCOPE AND SEQUENCE OF READING SKILLS ON THE RASCH SCALE

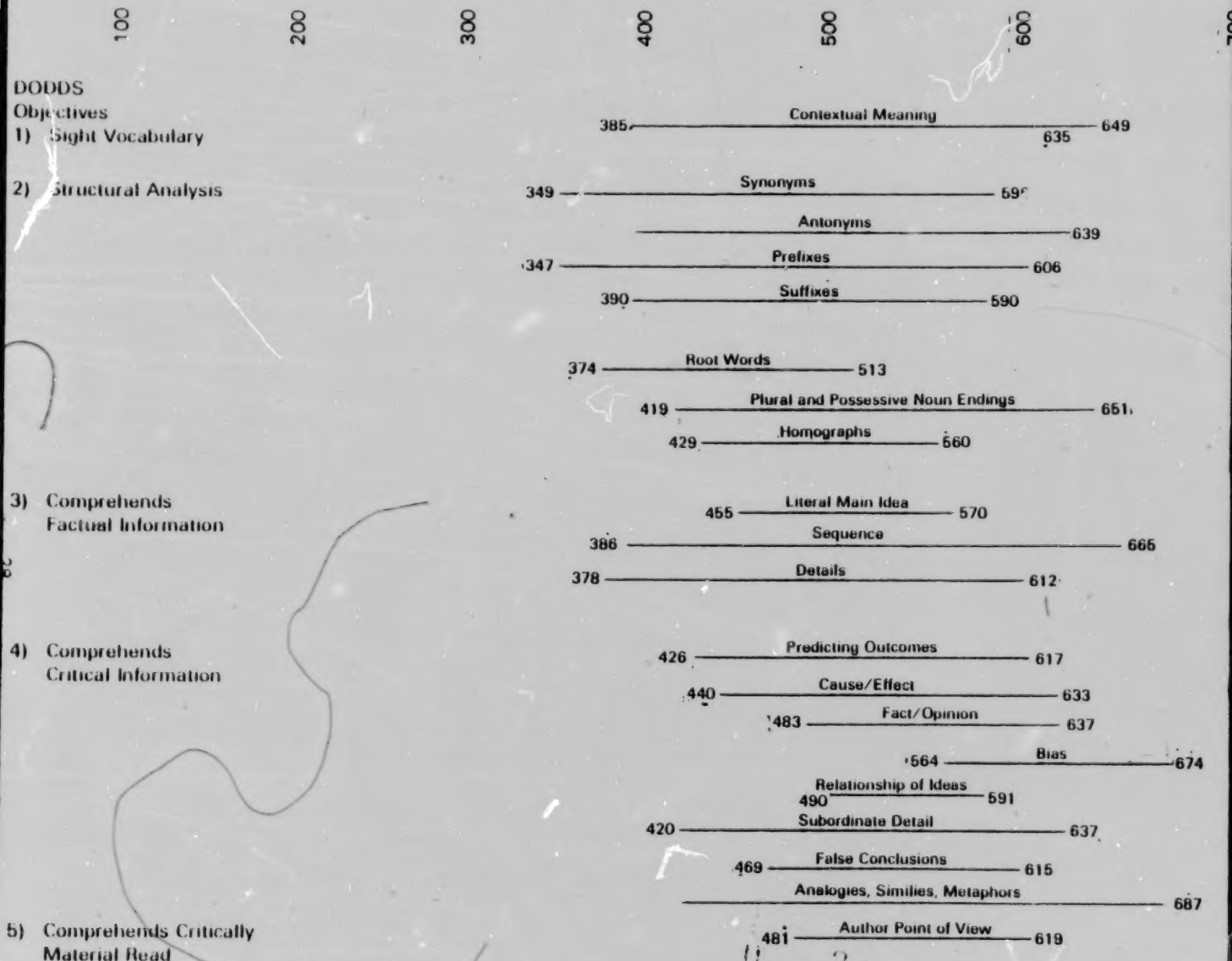


FIGURE 1

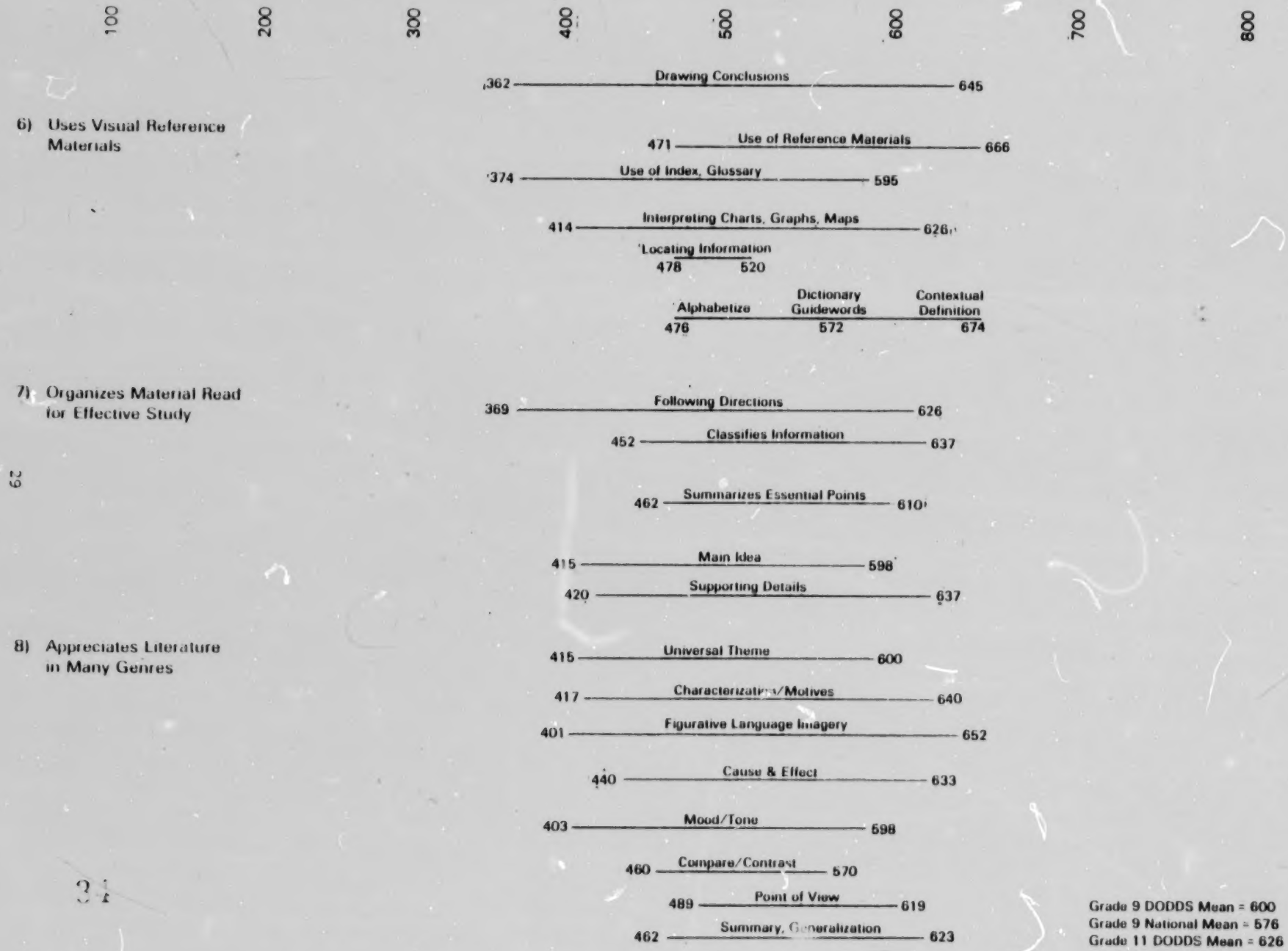

100
200
300
400
500
600
700
800
362 Drawing Conclusions 645
6) Uses Visual Reference Materials
471 Use of Reference Materials 666
374 Use of Index, Glossary 595
414 Interpreting Charts, Graphs, Maps 626
Locating Information
478 520
Alphabetize 476
Dictionary Guidewords 572
Contextual Definition 674
7) Organizes Material Read for Effective Study
369 Following Directions 626
452 Classifies Information 637
462 Summarizes Essential Points 610
415 Main Idea 598
420 Supporting Details 637
8) Appreciates Literature in Many Genres
415 Universal Theme 600
417 Characterization/Motives 640
401 Figurative Language Imagery 652
440 Cause & Effect 633
403 Mood/Tone 598
460 Compare/Contrast 570
489 Point of View 619
462 Summary, Generalization 623
Grade 9 DODDS Mean = 600
Grade 9 National Mean = 576
Grade 11 DODDS Mean = 626
Grade 11 National Mean = 604

FIGURE 1

FINDINGS

Grade 9

Based on student performance, 20% of the DoDDS ninth grade students are 1/2 S.D. or more above the mean (600). This represents a skill range of 623 to 672. Students with a score within this range are demonstrating a performance level well above the national mean (576) for ninth graders.

Scores within this difficulty range (623-672) fall within the "optimal" or advanced range of reading subskill development. As presented in Figure 1, the following reading subskills have an upper range of difficulty (above 622) and represent a high performance level in relation to the mean. It is inferred that subskills with difficulty levels that fall at or below the range of the mean are well within the reading capability level of the students within this score range (623-672).

Reading skills within this range are:

Sight Vocabulary
contextual clues

Structural Analysis
antonyms
prefixes
plural and possessive noun endings

Comprehension of Factual and Critical Information
sequencing
details
predicting outcomes
cause and effect
fact and opinion
analogies, similies, and metaphors
author point of view

Use of Visual Reference Materials
use of reference material
interpreting maps, graphs, charts
dictionary guide words
contextual definitions

Organization of Material Read for Study
following directions
classification of material
supporting details

Appreciation of Literature in Many Genres
characterization and motives
figurative language - imagery
cause and effect (evaluative)
author point of view (evaluative)
generalizations

These skills would represent a low performance level for students at or below the mean due to the high level of difficulty.

Approximately 58% of the DoDDS ninth grade students scored within a range of 577-622. Students within this score range have demonstrated reading performance contiguous with Normal Expectancy, as defined in the DoDDS Scope and Sequence Skills Guide for the ninth grade. DoDDS domains of reading development and the related subskills that fall within a difficulty range of 577-622 are listed below:

Structural Analysis and Sight Vocabulary
synonyms
suffixes
root words
homographs

Comprehension of Factual and Critical Information
literal main idea
relationship of ideas
predicting outcomes
subordinate detail
false conclusions
drawing conclusions

Use of Visual Reference Materials
use of index, glossary
locating information
contextual definitions
alphabetizing

Organization of Materials Read for Effective Study
summarizes essential points
main idea

Appreciation of Literature in Many Genres
universal theme
mood and tone
compare and contrast

These skills are high performance areas for students who score above the mean (600).

Approximately 22% of DoDDS ninth grade students fall Below Normal Expectancy range (396-576). All reading subskills within a range of 396 to 576 are presented in Figure 1 and represent an appropriate instructional range of difficulty for ninth grade students within this performance category.

Skills outside the ability range of this group would include recognizing bias and the upper range of the following subskills:

Sight Vocabulary
contextual meaning

Structural Analysis
antonyms
plurals and noun possessive endings

Comprehension - Factual and Critical
sequence
analogies, similies, and metaphors

Use of Reference Materials
interpreting graphs, charts, maps
contextual definitions

Organization of Material Read for Study
supporting details
summarizing essential points
characterization and motives
figurative language

Appreciation of Literature in Many Genres
point of view
cause and effect
summarization and generalization

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Sight Vocabulary

DoDDS Scope and Sequence reflects instructional emphasis for this objective at grades 1 through 4 with application of skills emphasized in grades 7 through 9. Use of contextual clues is emphasized also in grades 7 through 9 with general vocabulary development ongoing from grades 7 through 12. A look at Figure 1 will show that this subskill (contextual clues) has a difficulty range from 385 to 649. Because this skill has an upper limit yet to be reached by DoDDS students, continued instructional emphasis is recommended for all students. Advanced instruction would include etymology to continue vocabulary development. Students scoring below the mean should build their vocabulary in context with an emphasis at the literal and interpretive levels of comprehension.

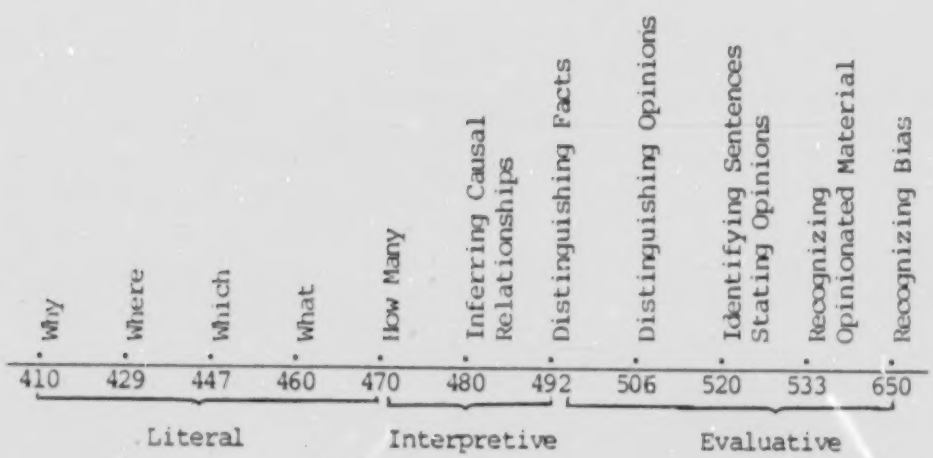
Structural Analysis

Excellent skill foundation in synonyms, prefixes, and suffixes. As presented in Figure 1, the subskill antonyms has an increasing range of difficulty and continued instruction is recommended. Students with performance levels below the mean should receive continued instruction, as these skills represent viable instructional areas for further vocabulary development and word recognition. These skills serve to enhance vocabulary comprehension when presented in context.

Comprehension of Factual and Critical Information

The following reading subskills show an upper range of difficulty that students within the score range (623-672) are capable of reaching; an upper range would be represented by questions at the evaluative levels of thinking: sequencing; details; predicting outcomes; cause and effect; fact and opinion; analogies, similies, and metaphors; and author point of view. The difficulty range and types of questions for the subskill detail are represented below.

DETAILS



As presented in Table 16, 22% of DoDDS ninth grade students are Below DoDDS Normal Expectancy (more than 1/2 S.D. below the mean), as defined by the Scope and Sequence Curricular Skills Guide. Student performance within this range (396-576) should be evaluated individually based on the student report and appropriate remediation prescribed.

Approximately 18% of this ninth grade group is within marginal performance (524-572) range (seventh to eighth grade functional level) and would benefit most from instructional "back-up" given in addition to the regular reading curriculum.

Student scores with a performance range of 523 or below represent approximately 4% of the DoDDS ninth grade student population. Students within this group probably have a functional reading level at or below fifth grade readability. Attitude and age are key factors in designing a remediation program for ninth graders. Students who show a performance level below the mean should receive additional emphasis at the literal level in addition to critical and evaluative reading. The ability to read for literal meaning—that is, for stated ideas—is influenced greatly by recognition of word meaning in context. Instruction in recognizing and using context and morphemic (structural) clues, adapting to shifts in word meaning and understanding figurative language serves to increase comprehension considerably. Literal comprehension is further enhanced when the reader perceives the way in which ideas are related. Various organization patterns, such as time order, comparison, contrast, and cause and effect, should be presented as "vehicles" used by writers to transmit ideas. Continued exposure to a variety of reading materials and writing styles will insure continued development of comprehension skills. To read inferentially, or "between the lines," is to draw conclusions, make generalizations, sense relationships, and predict outcomes. These deeper meanings can be inferred only after surface meanings are fully understood. Critical reading is a process of evaluating ideas or information and is facilitated by thought-provoking questions. Questioning strategies should be emphasized as mean performance (600) represents the lower range of difficulty in critical reading subskills, such as recognizing bias (564-674), contextual definitions, and metaphors.

Use of Visual Reference Materials

Locating information and alphabetizing should be the foundation skills emphasized for below expectancy performance. Use of index should extend to the glossary and be presented along with use of reference materials. Because contextual definitions and interpretive skills (see Figure 1) have an upper range of difficulty (666-674), instructional emphasis should continue for all students.

Organization of Material Read for Study

Continued emphasis is recommended in classification of information for advanced students as this subskill has an upper range of 637. The majority of DoDDS students did very well on following directions and summarizing essential points; however, these skills also have an upper range of difficulty yet to be reached by DoDDS advanced ninth grade students.

Again, emphasis on recognizing the main idea is recommended for student scores below the mean.

DoDDS Scope and Sequence shows an instructional emphasis on use of SQ3R techniques for content organization through grade 11. Students within a score range of 623 to 672 may be capable of applying this organizational technique to more advanced or technical reading material.

Appreciates Literature in Many Genres

According to DoDDS Scope and Sequence Skills Guide, instruction within this domain begins with grade 7; however, many of the subskills are not introduced until grade 9. Because each of the subskills has a range of difficulty that extends beyond 622, continued instruction utilizing materials of increasing complexity is recommended.

FINDINGS

Grade 11

Based on student performance, 38% of DoDDS eleventh grade students are 1/2 S.D. or more above the mean (626). This represents a skill range of 650-679. Students with a score within this range are demonstrating a performance level above the national mean (604) for eleventh graders.

Scores within this difficulty range fall within the "optimal" range of development for most reading subskills. It is inferred that subskills which have difficulty levels that fall within or below the range of the mean are within the reading skills capabilities of 38% of the DoDDS eleventh grade student population.

As presented in Figure 1, the following reading subskills have an upper range of difficulty above 650, and represent a high performance level in relation to the DoDDS eleventh grade mean (626).

Structural Analysis
plural and possessive noun endings

Comprehension of Factual and Critical Information
sequencing
recognizing bias
analogies, similies, and metaphors

Use of Visual Reference Materials
use of reference materials
contextual definitions

Appreciation of Literature in Many Genres
figurative language - imagery

These skill areas represent a low performance level for students at or below the mean. Instructional follow-up must include prerequisite skill development. Task analysis is highly recommended on an individual basis for low ability students.

Cloze procedures (syntactic deletions) as an instructional technique is one way to force students to become aware of syntactic as well as semantic relationships within a passage.

Rankin and Overholser (1969) have demonstrated that the Cloze procedure can be used effectively to diagnose intermediate grade students' sensitivity to context clues. Rankin has suggested that by constructing Cloze exercises from subject matter texts written at various levels of difficulty, the Cloze procedure could provide greater transfer between the remedial situation and the classroom.

Jongsma, Eugene. The Cloze Procedure as a Teaching Technique. ERIC/CRIER and the International Reading Association. 1971.

Approximately 47% of the DoDDS eleventh grade students scored within a range of 581 to 649 (see Table 17). Students within this scoring range have demonstrated reading performance contiguous with Normal Expectancy as defined by DoDDS Scope and Sequence Skills Guide for grade 11. Students within this score range demonstrate competence in the following subskills which fall within this range:

Structural Analysis and Sight Vocabulary
prefixes
synonyms
suffixes
root words
homographs
contextual meaning

Comprehension of Factual and Critical Information
literal main idea
details
predicting outcomes
cause and effect
relationship of ideas
fact and opinion
subordinate detail
false conclusions

Comprehension of Critically Read Material
author point of view
drawing conclusions

Use of Visual Reference Materials
use of index, glossary
interpreting, maps, graphs, and charts
locating information
dictionary guide words

Organization of Material Read for Effective Study
following directions
classification of information
summarizes points
main idea
supporting details

Appreciation of Literature in Many Genres
universal theme
characterization/motives
cause/effect
mood/tone
compare/contrast
point of view
summary, generalization

It is inferred that subskills have difficulty levels that fall at or below the mean (626) are within the range of capabilities of this 20 percent of the eleventh grade population. These skills were included in the listings above and are considered high performance skill areas for students who score within or above the range of the mean (581-649).

Approximately 15% of the DoDDS eleventh grade students fall Below Normal Expectancy range (580 or below).

All reading subskills within a range of 349 to 580 are represented in Figure 1 and represent an appropriate instructional range of difficulty for eleventh grade students within this category of performance. Skills outside the ability range of this group would include recognizing bias and the upper range of the following skills:

Sight Vocabulary
contextual meaning

Structural Analysis
antonyms
plural and noun possessive endings

Comprehension - Factual and Critical
sequence
analogies, similies, and metaphors

Use of Peference Materials
interpreting graphs, charts, and maps
contextual definitions

Organization of Material Read for Study
supporting details
summarizing essential points
characterization/motives
figurative language

Appreciation of Literature in Many Genres
point of view
cause/effect
summarizing and generalization

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Sight Vocabulary and Structural Analysis

DoDDS instructive emphasis for sight vocabulary occurs in grades 7 to 9. With a large percentage of eleventh grade students at or above the mean, continued emphasis will help prepare college-bound students for SAT and college entrance exams.

Students performing below the mean should build vocabulary and word attack skills in context. Advanced students should continue vocabulary development through etymology.

Comprehension of Factual and Critical Information

Excellent development in literal main idea, details, predicting outcomes, fact and opinion. Relationship of ideas is also well within capabilities of most DoDDS eleventh graders. Advanced students should concentrate on further development of recognizing bias, as the range of difficulty for this subskill exceeds eleventh grade mean performance.

Recognizing subordinate details also has a range of difficulty that extends beyond eleventh grade mean performance. Instructional emphasis on the use of SQ3R could extend this skill to technical reading material. Students below the mean should have intensified instruction at all levels of comprehension at a reading level appropriate for individual instruction. Comprehension is enhanced when the student recognizes relationships.

Comprehension of Critically Read Material

DoDDS eleventh grade students should have continued opportunities to draw conclusions based on materials read. Reading material that addresses analogies and abstractions would extend evaluative thinking skills and allow advanced students to reach the upper limits of those skills.

Remedial students should also be given opportunities to build on skills at the literal level, or higher levels of understanding will never be reached.

Use of Visual Reference Materials

Use of index and glossary and location of information skills show excellent development.

Use of reference materials is a subskill with a range of difficulty that exceeds mean performance (626). Continued emphasis of this subskill is recommended.

Contextual definitions also represent a subskill range above the mean. This skill, combined with contextual meaning, would serve to strengthen overall vocabulary development.

Students with a performance measure below the mean should have continued instruction in all subskills within this domain.

Organization of Material Pead for Effective Study

DoDDS eleventh grade students have a strong foundation in organizational skills. Formal organizational instruction begins in grade 4 and continues through the eleventh grade. This instructional emphasis may serve to account for the high performance of 85% of the students in reading comprehension skills.

Remedial instruction should include sequencing as it relates to organization of reading materials.

Appreciation of Literature in Many Genres

Continued emphasis is recommended through grade 12. Appropriate instructional emphasis should include use of figurative language and imagery. Contextual definitions should be part of the total instructional sequence within this domain.

For the 15% of the eleventh graders who fell below mean performance, instructional emphasis should include interpreting information. This skill could be applied to a literary approach to the teaching of reading and might be most beneficial to eleventh grade students.

Reading is not simple, nor is it a single skill. It is a complex process that consists of many different components. Students learn some skills and move on, but it takes time to gain overall proficiency in reading. What may be an achievement at one point in their reading development may not be good enough at another. This fact explains why some students can cope with early reading demands but not later ones. It also underscores the need for continuous and orderly reading experiences throughout the school years.

SUMMARY

READING

Overall performance in reading was above the national average for both 9th and 11th graders. With a mean score of 600, the ninth grade DoDDS students exceeded a national mean of 576 by a respectable margin. DoDDS eleventh graders achieved a mean score of 626, exceeding a national eleventh grade mean of 604 in reading comprehension.

Findings show that approximately 38% of all eleventh grade DoDDS students demonstrated reading performance levels above the mean, while 20 percent of all ninth graders also showed above-average reading skills. Ninth graders with a score within a range of 623-672; and eleventh graders with a score within a range of 650-679 should be counseled for college preparatory coursework.

Approximately 58% of DoDDS ninth grade students and 47% of the eleventh graders demonstrated reading skills within a normal expectancy range (1 S.D. around the mean).

Performance below normal expectancy was represented by a score range of 396-576 for ninth grade and 410-580 for the eleventh grade. Within this performance category, skills in reading comprehension range from "marginal" reading ability (6th-8th grade reading skills) to low levels of literacy (2nd-3rd grade level). Marginal students would benefit most from instructional back-up services in addition to the regular DoDDS curriculum.

A smaller percentage of both ninth and eleventh grade students would benefit most from a modified course of study designed to develop literacy in relation to life skills while at the same time enhancing comprehension of a variety of reading materials. Reading instruction should be available for all content areas for remedial students.

Curricular Implications

DoDDS students show excellent development of comprehension skills from concrete to abstract levels of thinking. The early emphasis on organization of content for study by use of SQ3R technique may be the contributing factor.

Instructional emphasis for grade nine should include advanced instruction in vocabulary development, contextual definitions, figurative language and abstractions. Emphasis on interpretive skills will strengthen critical reading.

Grade eleven students should continue vocabulary development in context, and should work with recognizing bias in various reading materials such as newspaper editorials and journal articles. Preparation for college exams is highly recommended.

Remedial follow-up based on an individual evaluation is highly recommended for students 1/2 S.D. or more below the mean at each grade level. Remedial emphasis at the eleventh grade should build on a strong literal base but focus on interpretive comprehension skills at the application level.

PERFORMANCE SUMMARY AND CURRICULUM
IMPLICATIONS FOR LANGUAGE ARTS

INTRODUCTION

The purpose of this section of the technical report is to provide a curricular interpretation of language arts performance for grades 9 and 11.

In order to examine student performance in relation to a total curricular sequence, the DoDDS Scope and Sequence Curricular Skills Guide was placed on the Rasch measurement scale. Seven broad categories or domains of language arts skills were identified by DoDDS as critical for language arts development. These seven domains are listed below:

1. Capitalization
2. Punctuation
3. Usage
4. Sentence Structure
5. Building and Changing Sentences
6. Paragraphs
7. Spelling

Each domain contains subskills, each of which has a range of difficulty which has been graphically displayed in Figure 2.

To examine student performance in relation to the difficulty ranges of subkills within each domain, the mean scores for DoDDS ninth and eleventh grade students, 577 and 590 respectively, were placed vertically on this continuum of DoDDS language arts scores.

FINDINGS

Student performance for all ninth and eleventh graders are reported in terms of group percentages and standard deviations around the mean. Findings of these analyses are summarized in Tables 18 and 19.

DoDDS Normal Expectancy represents 1 S.D. around the mean (1/2 S.D. above and 1/2 below) and is expressed in terms of score range in relation to the DoDDS Scope and Sequence of Language Arts Skills.

Because some language arts subskills have an upper range of difficulty that extends beyond the "normal" range (as defined above), performance at this level is considered optimal or Above DoDDS Normal Expectancy for students as defined by DoDDS Scope and Sequence Curricular Skills Guide.

Conversely, score ranges falling Below DoDDS Normal Expectancy are represented by those skills that show a difficulty range of 1/2 S.D. or more below the mean.

The findings for each grade level will be presented separately along with instructional recommendations.

TABLE 18

SUMMARY OF LANGUAGE ARTS SKILL PERFORMANCE
FOR GRADE 9 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	557 and Below	558-596	597 and Above
Implications	Students are below grade level expectancy in skills. Consistent practice in skill-building exercises desirable. Repetition of exercises in presentation of new concepts desirable. Intensive remediation efforts indicated for student measures below 518 (371 = 5.82%).	Students in this score range are on grade level and approaching optimal development of most skill areas for Grade Nine.	Capable of more advanced work at grade level. Emphasis should be on expository writing, especially the short theme and paragraph.
	1,508 = 24.28%	2,782 = 43.64%	2,045 = 32.08%

TABLE 19

SUMMARY OF LANGUAGE ARTS SKILL PERFORMANCE
FOR GRADE 11 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	566 and Below	567-613	614 and Above
Implications	Students are below grade level expectancy in skills. Consistent practice in skill-building exercises desirable. Intensive remediation efforts indicated for student measures below 519.	Students in this score range are on grade level and approaching optimal development of most skill areas for Grade Eleven.	Capable of advanced-level work, emphasis should be on expository writing, especially longer themes and essays.
	1,073 = 28.96%	1,370 = 36.99%	1,261 = 34.04%

DODDS SCOPE AND SEQUENCE OF LANGUAGE ARTS SKILLS ON THE RASCH CONTINUUM

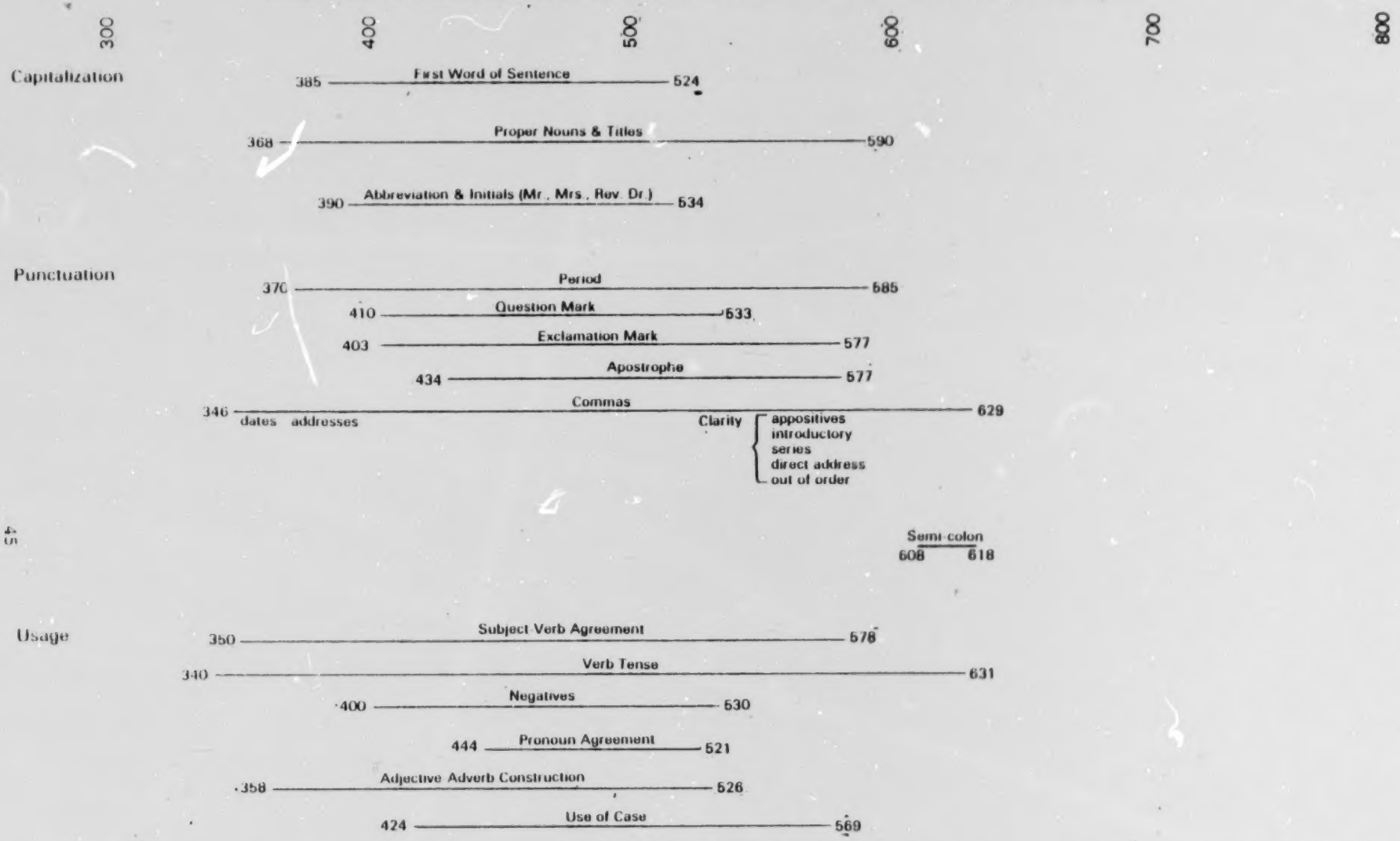


FIGURE 2

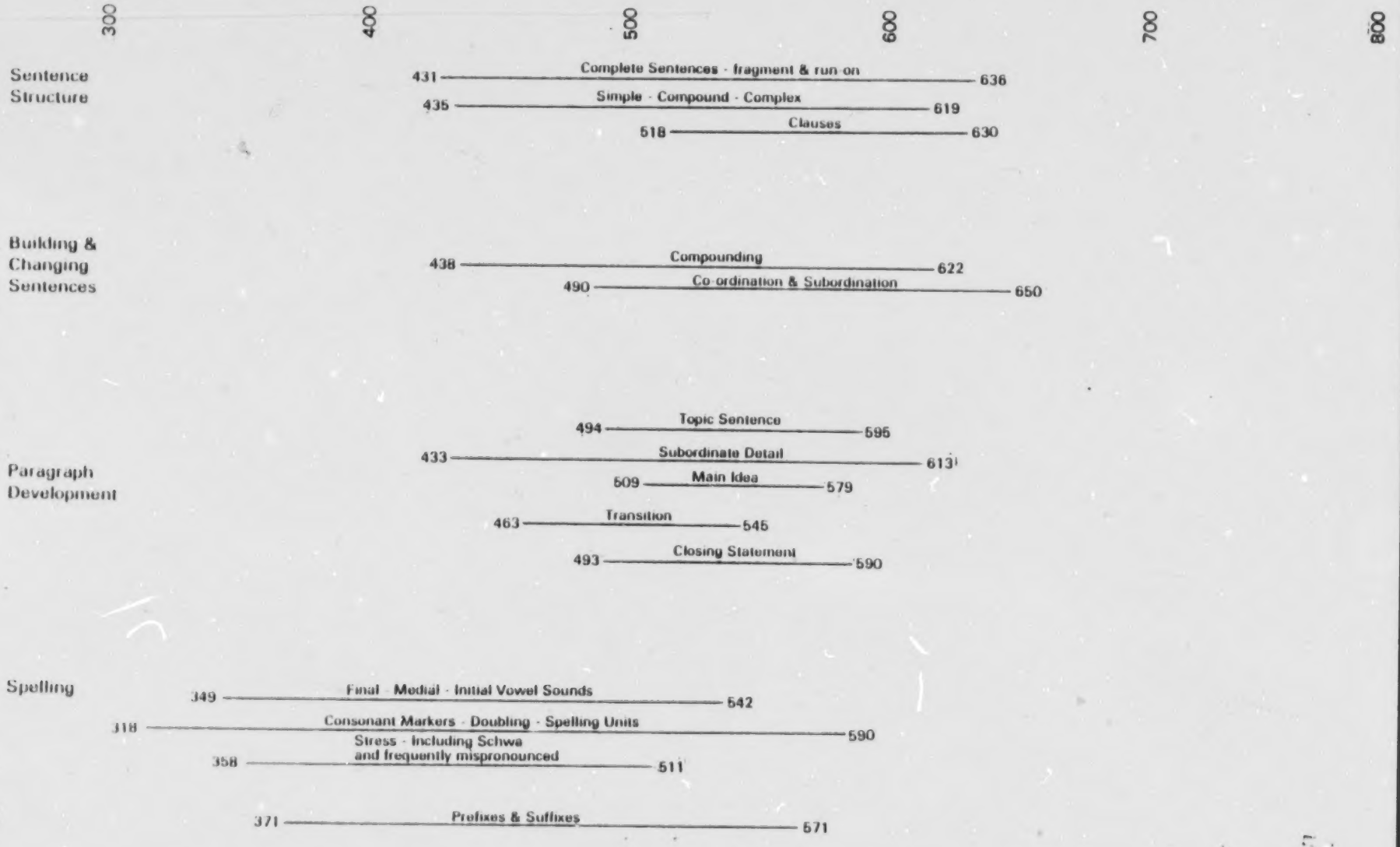


FIGURE 2

Grade 9 DODDS Mean = 577
Grade 9 National Mean = 555
Grade 11 DODDS Mean = 590
Grade 11 National Mean = 574

FINDINGS

Grade 9

Based on student performance, 32% of the DoDDS ninth grade students are 1/2 S.D. or more above the mean (577). This represents a skill range of 597 to 700. Students with a score within this range are demonstrating a performance level well above the national mean for ninth graders.

Scores within this difficulty range (597-700) fall within the "optimal" range of language arts subskills. As presented in Figure 2, the following language arts subskills have an upper range of difficulty above 596, and represent a high performance level in relation to the mean. It is inferred that subskills which have difficulty levels that fall within or below the range of the mean are within the language arts capability level of this 32% of the DoDDS ninth grade students.

Punctuation
commas
semi-colon

Usage
verb tense

Sentence Structure
compound sentences, fragments, and run-on sentences
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordination and subordination

Paragraph Development
subordinate detail

Students scoring more than 1/2 S.D. above the mean are expected to be competent in other subskills in language arts specified by DoDDS, as these skills are less difficult and should be within their ability range.

About 44% of the DoDDS ninth grade students scored within a range of 558-596. Students within this scoring range have demonstrated language arts performance contiguous with normal expectancy, as defined in the DoDDS Scope and Sequence Skills Guide for the ninth grade. DoDDS domains of language arts development and the related subskills that fall within a difficulty range of 558-596 are listed below:

Capitalization
proper nouns and titles

Punctuation
period
exclamation mark
apostrophe
commas

Usage
subject-verb agreement
verb tense
use of case

Sentence Structure
complete sentences, fragments, and run-on sentences
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordination and subordination

Paragraph Development
topic sentence
subordinate detail
main idea
transition
closing statement

Spelling
consonant markers, doubling, spelling units
prefixes and suffixes

These are skills in which ninth grade students scoring in the normal range are still gaining ground. As noted above, students scoring more than 1/2 S.D. above the mean should do well in these skills.

About 24% of DoDDS ninth grade students fell into the below normal expectancy range (less than 558). As shown in Figure 2, all language arts subskills are represented, including those with difficulty levels below 558. These represent an appropriate instructional range of difficulty for ninth grade students in this performance category.

Skills beyond the ability range of this group would include the use of the semi-colon and the upper ranges of the following subskills:

Capitalization
proper nouns and titles

Punctuation
period
exclamation mark
apostrophe
commas

Usage
subject-verb agreement
verb tense
use of case

Sentence Structure
complete sentences, fragments, and run-ons
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordiantion and subordination

Paragraph Development
topic sentence
subordinate detail
main idea
closing statement

Spelling
consonant markers, doubling, spelling units
prefixes and suffixes

Student performance within this range (below 558) should be evaluated individually, and appropriate remediation prescribed.

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Capitalization

Although capitalization rules for books, songs, stories, etc., are introduced and emphasized from grades 2 through 5 in DoDDS Scope and Sequence, maintenance lessons and review are necessary since this is a more difficult capitalization concept. Special emphasis should be given to determining important words in titles, as well as to the capitalization mechanics employed when citing publication sources.

Punctuation

Although the difficulty range for the uses of the period and the comma extend above the grade 9 mean (see Figure 2), DoDDS performance can be considered "normal." The precise use of the period is contingent upon a mastery of many concepts: for example, when is the period more appropriate than any other mark of punctuation? If the distinction must be made among the period, semi-colon, or colon, the grade 9 student is involved with punctuation skills which are currently being learned. Skill mastery in all uses of the comma would also be considered advanced for grade 9 students: for example, commas with non-restrictive clauses would be considered advanced, since non-restrictive clauses are emphasized in grades 9 through 12.

DoDDS students scoring above the range of the mean are capable of mastery of the more advanced skills of punctuation such as using the semi-colon to separate independent clauses in a compound or compound/complex sentence, or to separate parts of a series when internal commas are used.

Usage

The difficulty range for verb tense extends above the grade 9 mean range. The more difficult items in this skill require a knowledge of the nomenclature used in formal grammar. For example:

> The correct past tense
> of the verb go is:
>
> A. going
> B. went
> C. gone
> D. have gone

Instructional needs would include appropriate review of grammatical nomenclature. Emphasis should be given to subject-verb agreement, especially when s-v are interrupted by non-matching modifiers: for example, a singular subject is interrupted from the verb by a plural object of the preposition.

Sentence Structure

The skills difficulty ranges for simple, compound, and complex sentences go beyond the grade 9 mean (see Figure 2). Subordinate and relative clauses also go beyond the mean. DoDDS Scope and Sequence indicates that these skills are emphasized in grade 9; however, they are also emphasized in grades 10 through 12. Students can be expected to have some knowledge of the nomenclature and concepts of these skills in grade 9 without having achieved mastery.

Building and Changing Sentences

Emphasis should be placed on students writing original sentences which illustrate compounding, coordination, and subordination of ideas. A review of grammatical nomenclature is also suggested. An example of an item that would be difficult for students who scored at or below the mean involves a knowledge of formal grammar:

Which sentence has a compound predicate?

A. The President of Council was given the oath of office and assumed her new duties immediately.
B. The two council leaders took their oaths of office.
C. The President and Vice President of Council, once they had assumed office, swore in the secretaries and historian.
D. The two council leaders and the two secretaries sat on the stage.

Paragraph Development

Grade 9 student measuring within the range of the mean or above are appropriately progressing with expository writing-readiness skills. Many aspects of the following skills are within mastery range of students within this group:

- topic sentence
- subordinate detail
- main idea
  -identify main idea in paragraph;
  other ideas subordinated;
  use of appropriate details to support main idea
- transitions
  -transitions between sentences
  -transitions between paragraphs
- closing statement

Frequent composition assignments with emphasis on the expository paragraph are appropriate. Students are progressing within a desirable age/skill relationship.

Spelling

Students within the range of the mean show mastery of the following selected spelling skills:

- vowel sounds
  - -initial long vowel sound
    (e.g., able, evening)
  - -medial long vowel sound
    (e.g., radio, shining, polite)
  - -final long vowel sound
    (e.g., why, destroy, piano)
  - -vowel units
    (e.g., please, street, raise)
- consonant sounds
  - -markers
    (e.g., give, use, cause)
  - -doubling
    (e.g., address, recess)
  - -consonant spelling units
    (e.g., break, geography)
- stress
  - -frequently misspelled due to pronunciation
    (e.g., February, library)
  - -schwa sound
    (e.g., often)

Continued skills development is required in word forming and doubling consonant markers.

- work forming
  - -prefixes
    (e.g., misspell, until, professor)
  - -suffixes
    (e.g., matches, captivity, heroes)
- doubling consonant markers
  (e.g., accommodate, occasion, possession, recommend)

FINDINGS

Grade 11

Based on student performance, about 34% of DoDDS eleventh grade students are 1/2 S.D. or more above the mean (590). This represents a skill range of 614 to 715. Students within this range are demonstrating a performance level above the national mean for eleventh graders.

Scores within this difficulty range fall within the "optimal" range of development for most language arts subskills. It is inferred that subskills which have difficulty levels falling within or below the range of the mean are within the language arts capabilities of this 34% of the DoDDS eleventh grade student population.

As presented in Figure 2, the following language arts subskills have an upper range of difficulty above 614, and represent a high performance level in relation to the DoDDS mean (590). Students whose performance is at or below the mean will have difficulty with these skill areas, especially at their upper difficulty levels.

Punctuation
commas, especially in non-restrictive clauses
semi-colon

Usage
verb tense

Sentence Structure
complete sentences, fragments, and run-on sentences
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordination and subordination

Slightly less than 40% (36.99%) of the DoDDS eleventh grade students scored within a range of 567 to 613. Students within this scoring range have demonstrated language arts performance contiguous with normal expectancy, as defined by the DoDDS Scope and Sequence Skill Guide for grade 11. Students within this score range demonstrate competence in the following subskills falling within this range:

Capitalization
proper nouns and titles

Punctuation
period
exclamation mark
apostrophe
commas
semi-colon

Usage
subject-verb agreement
verb tense
use of case

Sentence Structure
complete sentences, fragments, and run-on sentences
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordination and subordination

Paragraph Development
topic sentence
subordinate detail
main idea
closing statement

Spelling
consonant markers, doubling, spelling units
prefixes and suffixes

It is inferred that, where students within 1/2 S.D. of the mean are often still in the process of acquiring complete mastery of these skills, students more than 1/2 S.D. above the mean have more thorough control of them. Similarly, it is to be inferred that students performing at or near the level of the mean have acquired mastery of those skills whose upper level of difficulty is below the point 1/2 S.D. below the mean.

Slightly more than one-fourth (28.96%) of the DoDDS eleventh grade students fell in the below-normal expectancy range (scores less than 567). All language arts subskills are represented in Figure 2, and represent an appropriate instructional range of difficulty for eleventh grade students in this performance category. Skills outside the ability range of this group would include use of the semi-colon and the upper range of the following subskills:

Capitalization
proper nouns and titles

Punctuation
period
exclamation mark
apostrophe
commas

Usage
subject-verb agreement
verb tense
use of case

Sentence Structure
complete sentences, sentence fragments, and run-on sentences
simple, compound, and complex sentences
clauses

Building and Changing Sentences
compounding
coordination and subordination

Paragraph Development
topic sentence
subordinate detail
main idea
transition
closing statement

Spelling
consonant markers, doubling, spelling units
prefixes and suffixes

As was mentioned in the ninth grade summary, the individual student's score must be the determining factor for the remediation to be implemented.

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Capitalization

Excellent skills foundation. Virtually all rules are introduced by grade 5 in DoDDS Scope and Sequence. Students who measure below the mean should review concepts for determining proper nouns; and skills maintenance practice is essential for most students. Special review should be given to determining important words in titles, as well as to the capitalization mechanics employed when citing publication sources.

Punctuation

Excellent skills foundation. The use of commas with non-restrictive clauses and a review of commas needed for clarity (appositive, out of natural order, series, etc.) would be appropriate. More advanced concepts which need emphasis are the uses of the semi-colon to separate independent clauses in a compound or compound/complex sentence, or to separate parts of a series when internal commas are used.

Usage

Skills maintenance lessons with an emphasis on subject-verb agreement would be beneficial for most students. An example of an item which would be considered more difficult for a student who scores in the range of the mean involves the interruption of the subject-verb with a prepositional phrase. The student must know how the subject and the object of the preposition are differentiated:

> Choose the word or group of words
> that correctly completes the sentence.
>
> The many voices of the chorus
> _____ loud and clear.
>
> A. sound
> B. sounds
> C. sounding
> D. to sound

Review of grammatical nomenclature in identifying verb tense seems appropriate for most students.

Sentence Structure

Most students do well with identifying non-sentences; more emphasis seems appropriate in working with run-on sentences. The structure of the complex sentence and of the inherent use and identification of clauses is another area of apparent need. DoDDS Scope and Sequence indicates instruction in clauses is from grades 9 through 12; therefore, performance can be considered within normal expectations for grade 11.

Building and Changing Sentences

Continued emphasis in this skill is appropriate for most students. More advanced application of compounding ideas as well as coordinating and subordinating elements within sentences would be beneficial. An example of an item which would be considered difficult for most students measuring within the range of the mean:

> Daisy likes nice clothes.
>
> She won't spend much money on them.
>
> Select the sentence below which gives equal importance to the ideas in each sentence above.
>
> A. Although Daisy likes nice clothes, she won't spend money on them.
> B. Daisy likes nice clothes, but she won't spend much money on them.
> C. Even though Daisy won't spend much money on them, she still likes nice clothes.
> D. Daisy won't spend much money on the nice clothes that she likes.

Paragraph Development

DoDDS students measuring within the range of the mean or above show expository writing readiness. In other words, they should experience no difficulty in handling the elements of the paragraph, such as the topic sentence, developing the main idea, or making transitions. Frequent expository writing assignments should be beneficial.

Spelling

Students within the range of the mean show mastery of the following selected spelling skills:

- vowel sounds
  - -initial long vowel sound
    (e.g., able, evening)
  - -medial long vowel sound
    (e.g., radio, shining, polite)
  - -final long vowel sound
    (e.g., why, destroy, piano)
  - -vowel units
    (e.g., please, street, raise)

- consonant sounds
  -markers
    (e.g., give, use, cause)
  -doubling
    (e.g., address, recess)
  -consonant spelling units
    (e.g., break, geography)

- stress
  -frequently misspelled due to pronunciation
    (e.g., February, library)
  -schwa sound
    (e.g., often)

- word forming
  -prefixes
    (e.g., income, until, confess, advise)
  -suffixes
    (e.g., matches, captivity, heroes)

Continued practice is indicated in the use of doubling consonant markers.

- doubling consonant markers
    (e.g., accommodate, occasion, possession, recommend)

SUMMARY

LANGUAGE ARTS

Overall performance of DoDDS ninth and eleventh grade students in language arts was above the national means (555 and 574 respectively).

With a ninth grade mean of 577, 44% of DoDDS ninth grade students and approximately 37% of the eleventh grade students demonstrated language arts skills within a normal expectancy range (1 S.D. around the mean).

Findings showed that 32% of DoDDS ninth grade students and 34% of all DoDDS eleventh graders have demonstrated language skills above normal expectancy levels as specified by DoDDS. Performance below normal expectancy was represented by a score range of 533 or below. Approximately 24% of all ninth graders fell within this performance category. Almost 29% of DoDDS eleventh grade students fell below normal expectancy (scores less than 567).

For students demonstrating below normal expectancy performance, individual skill evaluation is highly recommended. Remedial follow-up based on individual needs should include writing skills (punctuation, capitalization, usage) as they appear within the body of a paragraph or writing sample.

Curricular Implications

The majority of DoDDS students showed strengths in spelling skills considered basic for high school students. For example, words frequently misspelled due to mispronunciation (spelling "demons") presented no problem. Other apparent curricular strengths included subject/verb agreement and related composition skills such as paragraph development. Eleventh grade teachers should capitalize on these foundation skills by planning creative expository writing activities.

Instructional emphasis for grade 9 students should include maintenance lessons and review for capitalization and punctuation. Advanced students are ready for more difficult uses of punctuation, such as the semi-colon to separate independent clauses.

Formal instruction on usage should include appropriate review of grammatical nomenclature.

Sentence structure and writing skills should emphasize writing original sentences which illustrate compounding, coordination and subordination of ideas. A review of grammatical nomenclature is recommended.

Paragraph development skills should continue to increase in complexity. DoDDS students demonstrate excellent foundation skills in related subskill areas.

Grade 11 students should continue to build upon an excellent language foundation. Technical writing and exposure to a variety of expository styles will serve to enhance basic writing skills. Maintenance lessons on advanced punctuation and usage is also recommended. Rigorous course work in writing and grammar should be available after grade 9 for college-bound students.

PERFORMANCE SUMMARY AND CURRICULUM IMPLICATIONS FOR MATHEMATICS

INTRODUCTION

The purpose of this section of the technical report is to provide a curricular interpretation of mathematics performance for grades 7 and 11.

In order to examine student performance in relation to a total curricular sequence, the DoDDS Scope and Sequence Curricular Skills Guide was placed on the Rasch measurement scale. Eight broad categories or domains of mathematics skills were identified by DoDDS as critical for mathematics development. These eight domains are listed below:

1. Number Awareness
2. Computational Skills
3. Problem Solving
4. Data Collection
5. Measurements
6. Predictions
7. Geometry
8. Sets

Each domain contains subskills, each of which has a range of difficulty which has been graphically displayed in Figure 3.

To examine student performance in relation to the difficulty ranges of subskills within each domain, the mean scores for DoDDS seventh and eleventh grade students, 530 and 574 respectively, were placed vertically on this continuum of DoDDS mathematics skills.

FINDINGS

Student performance for all seventh and eleventh graders are reported in terms of group percentages and standard deviations around the mean. Findings of these analyses are summarized in Tables 20 and 21.

DoDDS Normal Expectancy represents 1 S.D. around the mean (1/2 S.D. above and 1/2 below) and is expressed in terms of score range in relation to the DoDDS Scope and Sequence of Mathematics Skills.

Because some mathematics subskills have an upper range of difficulty that extends beyond the "normal" range (as defined above), performance at this level is considered optimal or Above DoDDS Normal Expectancy students as defined by DoDDS Scope and Sequence Curricular Skills Guide.

Conversely, score ranges falling Below DoDDS Normal Expectancy are represented by those skills that show a difficulty range of 1/2 S.D. or more below the mean.

The findings for each grade level will be presented separately along with instructional recommendations.

TABLE 20

MATHEMATICS
SKILL LEVELS
FOR GRADE 7 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	353-507	508-575	576-674
Implications	Much emphasis on skills maintenance indicated. -Students are at 6-7 level in skills. Presentation of new concepts need to be backed with re-evaluation and reteaching of formerly-introduced concepts. Intensive remediation efforts are advisable for student measures below 460.	Normal grade 7 range of skills.	Capable of more advanced work at grade level. Emphasis should be on application of skills in more complex problem-solving situations.
Percent of DoDDS Students in Score Range	29.4% 2257 Students	54.3% 4160 Students	16.2% 1244 Students

$\bar{X}$ = 530
N = 7,661
SD = 45

TABLE 21
MATHEMATICS
SKILL LEVELS
FOR GRADE 11 STUDENTS
BASED ON 1979 DoDDS TESTING PROGRAM RESULTS

Score Range	272-548	549-599	600-674
Implications	Much emphasis on skills maintenance indicated students are at 9-10 level in skills. Presentation of new concepts need to be backed with re-evaluation and reteaching of prior material. Recency of instruction might be a factor. Intensive remediation advisable for student measures below.	Normal grade 11 range of skills.	Capable of more advanced work at grade level. Emphasis should be on application of skills in more complex problem-solving situations.
Percent of DoDDS Students in Score Range	30.8 % 1332 Students	34.3 % 1478 Students	34.9 % 1508 Students

$\bar{X}$ 574
N 4,318

DODDS MATHEMATICS SCOPE AND SEQUENCE ON THE RASCH SCALE

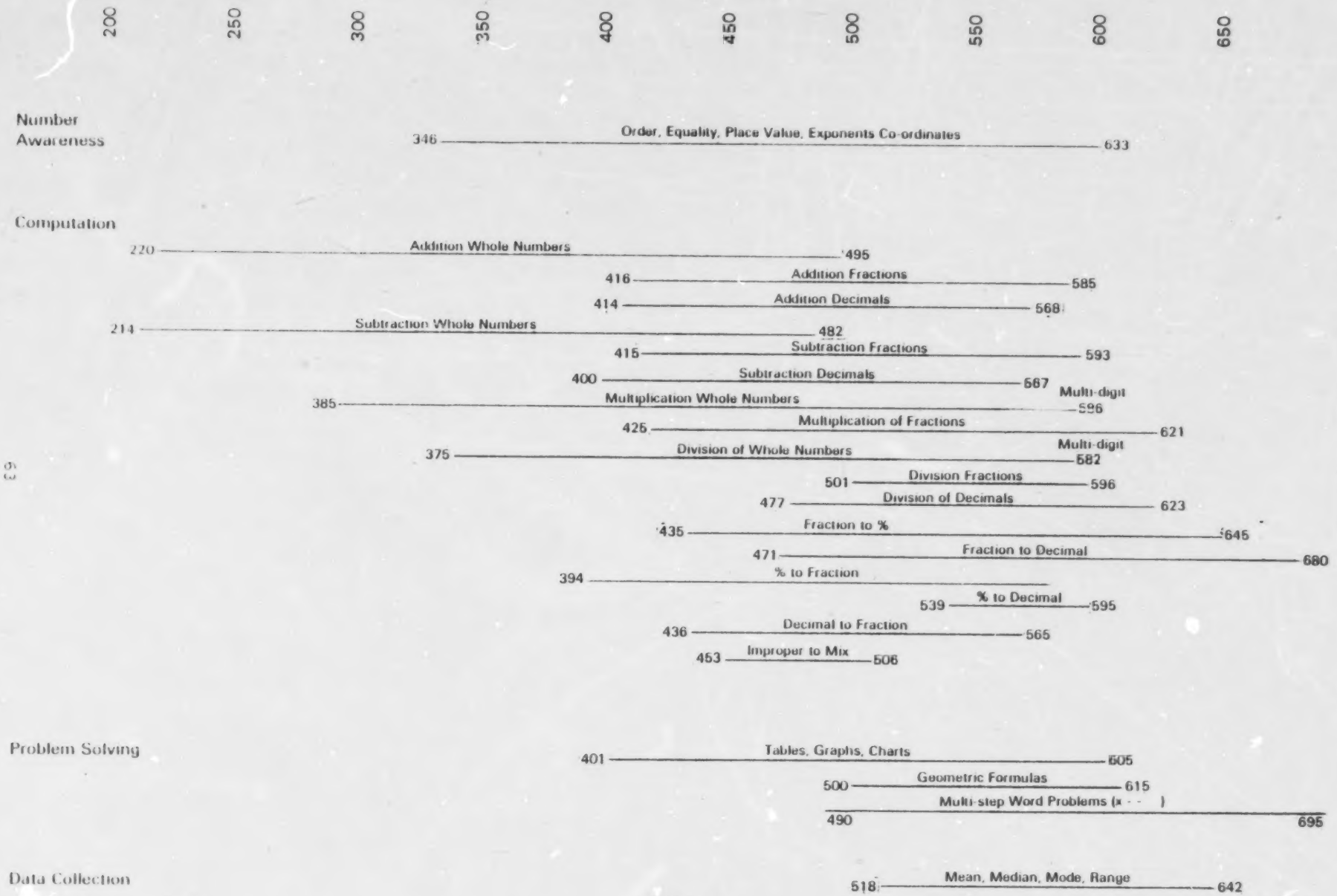


FIGURE 3

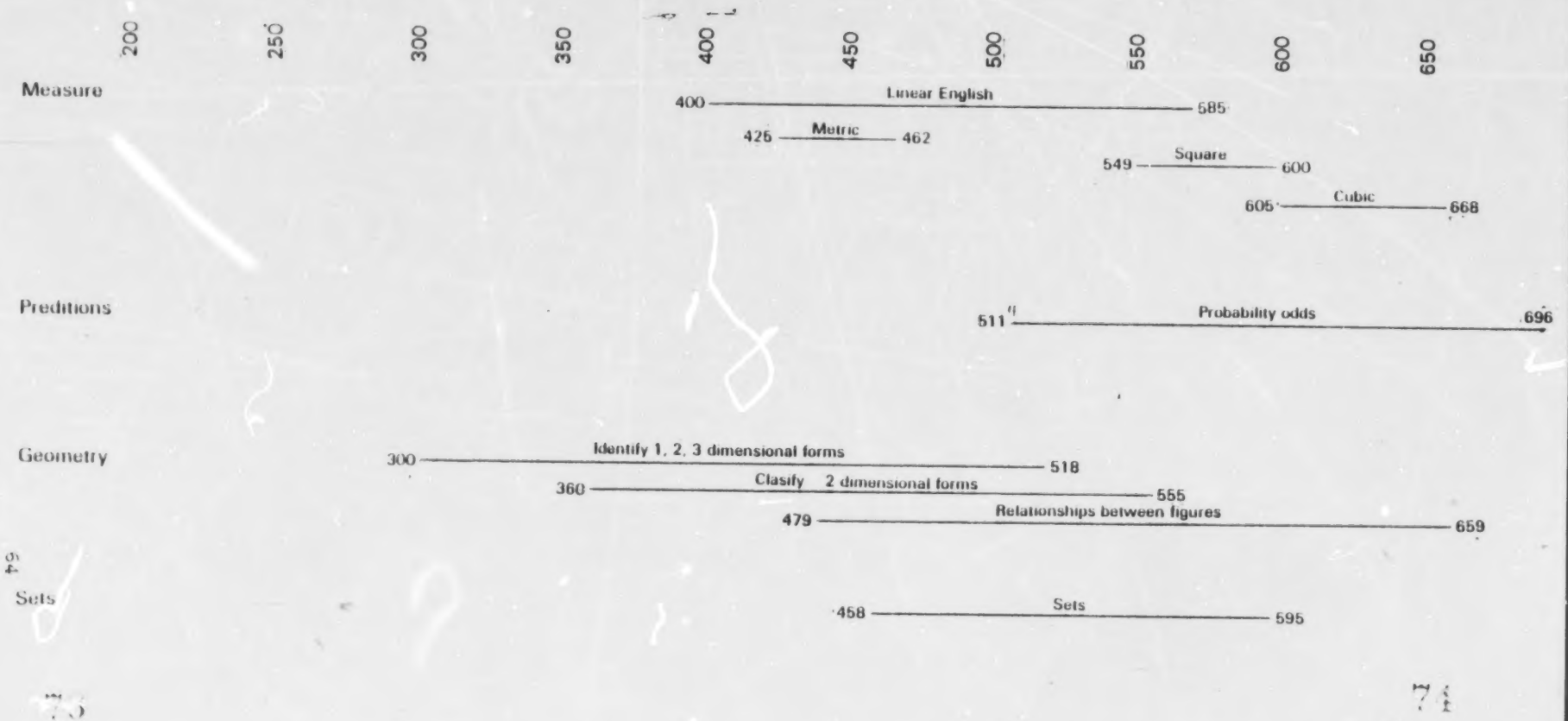


FIGURE 3

Grade 7 DODDS Mean = 630
Grade 7 National Mean = 510
Grade 11 DODDS Mean = 574
Grade 11 National Mean = 570

FINDINGS

Grade 7

Based on student performance, 16% of the DoDDS seventh grade students are 1/2 S.D. or more above the mean (530). This represents a skill range of 576 to 674. Students with a score within this range are demonstrating a performance level well above the national mean for seventh graders.

Scores within this difficulty range (576-674) fall within the "optimal" range of mathematics subskills. As presented in Figure 3, the following mathematics subskills have an upper range of difficulty above 576, and represent a high performance level in relation to the mean. It is inferred that subskills which have difficulty levels that fall within or below the range of the mean are within the mathematics capability level of this 16% of the DoDDS seventh grade students.

Number Awareness
exponents, coordinates

Computation
addition of fractions
subtraction of fractions
multiplication of multi-digit whole numbers
multiplication of fractions
division of whole numbers (multi-digit)
division of fractions
division of decimals
fraction to percent
fraction to decimal
percent to fraction
percent to decimal
decimal to fraction

Problem Solving
tables, charts, graphs
geometric formulas
multi-step word problems

Data Collection
mean, median, mode, range

Measure
linear English
square measure
cubic measure

Predictions
probability

Geometry
relationships between figures

Sets
sets

Students scoring more than 1/2 S.D. above the mean are expected to be competent in other subskills in mathematics as specified by DoDDS, as these skills are less difficult and should be within their ability range.

Over one-half (54%) of the DoDDS seventh grade students scored within a range of 508-575, 1/2 S.D. on either side of the mean. Students within this score range have demonstrated mathematics proficiency with normal expectancy, as defined in the DoDDS Scope and Sequence Skills Guide for the seventh grade. DoDDS domains of mathematics development and the related subskills that fall within a difficulty range of 508-575 are listed below:

Number Awareness
order, equality, place value, exponents, coordinates

Computation
addition of fractions
addition of decimals
subtraction of fractions
subtraction of decimals
multiplication of whole numbers
multiplication of fractions
division of whole numbers
division of fractions
division of decimals
fraction to percent
fraction to decimal
percent to fraction
percent to decimal
decimal to fraction

Problem Solving
tables, graphs, charts
geometric formulas
multi-step word problems

Data Collection
mean, median, mode, range

Measure
linear English
square measure

Predictions
probability

Geometry
identify 1, 2, 3 dimensional forms
classify 2 dimensional forms
relationships between figures

Sets
sets

These are skills in which seventh grade students scoring in the normal range are still gaining ground. As noted, students scoring more than 1/2 S.D. above the mean should do better in these skills.

About 29% of DoDDS seventh grade students fell in the below-normal expectancy range (418-507). As shown in Figure 3, all mathematics subskills are represented, including those with difficulty levels below 508. These represent an appropriate instructional range of difficulty for seventh grade students in this performance category.

Skills beyond the ability range of this group would include the domain of data collection, square and cubic measure, predictions, and the upper ranges of the following subskills:

Number Awareness
order, equality, place value, exponents, coordinates

Computation
addition of fractions
addition of decimals
subtraction of fractions
subtraction of decimals
multiplication of whole numbers
multiplication of fractions
division of whole numbers
division of fractions
division of decimals
fraction to percent
fraction to decimal
percent to fraction
percent to decimal
decimal to fraction

Problem Solving
tables, charts, graphs
geometric formulas
multi-step word problems

Measure
linear English

Geometry
identify 1, 2, 3 dimensional forms
classify 2 dimensional forms
relationships between figures

Sets
Sets

Student performance within this range (418-507) should be evaluated individually, and appropriate remediation prescribed.

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Number Awareness - excellent skill development. An excellent foundation for advanced students to explore number theory.

Computational Skills - a high level of proficiency has been achieved in computation with whole numbers and fractions.

In the subskill area of fractions, division of fractions presents some problems; an example of the magnitude of difficulty for most seventh graders in division of fractions is one which takes a form similar to $3\frac{7}{8} \div 3\frac{2}{3}$.

An examination of steps to solve such a problem indicates the student must be able to recognize the need for and to: change a mixed number to an improper fraction; recognize the fact that division of fractions involves a change in sign accompanied by inversion of the second term; cancellation across terms, if possible; multiplication of numerators and denominators to form the new term; and finally reduction to the simplest form. Errors can occur at any step. They may be caused by carelessness, inability to remember the steps necessary for solution, or inability to perform at a lower developmental level (inability to multiply) necessary for a solution at this level of complexity. An examination of the individual student report will enable the classroom teacher to eliminate some of these factors when providing remediation.

In the area of conversion among fractions, percents, and decimals, we can observe directly how Rasch measures a student's place in the prescribed curriculum. DoDDS curriculum (as stated in the Scope and Sequence) designates eighth grade as the one in which ability to convert from a percent to a fraction is a normal expectancy. Figure 3 shows that particular skill at a difficulty level above that achieved by the seventh graders.

Problem Solving - It is in this area of the mathematics curriculum that we see the greatest disparity between grade level expectancies as stated in the DoDDS Scope and Sequence and student performance. The test results indicate that much practice and greater curricular stress might be given to examples of the following type:

Example 1: Two jet planes take off simultaneously from the same airport. One flies east at an average speed of 610 mph. The other flies west at an average speed of 550 mph. In how many hours will they be 6,360 miles apart?

In this multi-step problem, the student must understand the use of formula d=rt, be able to define the variable, find the distance each plane will travel in "h" (the variable) hours, set up the equation 610h + 550h = 6360, and solve the equation for h.

Example 2: The formula for the perimeter of a square with side s is p=4s. If s is doubled, how does the perimeter change?

Data Collection - The attributes of data collection, meaning and use of median, mode, and range have a difficulty level of 512 to 640. If this area is one which has great importance in DoDDS curricula, greater emphasis on the use of other than simple averages (which are the kinds of problems at lower levels) is indicated. Some thought might also be given to re-evaluating the grade level at which the Scope and Sequence set these levels as normal expectancies.

Measurement - The test results indicate that the ability to deal with linear measure is well established for most seventh graders. Much work is indicated in the areas of square and cubic measure to meet normal expectancies as indicated by DoDDS Scope and Sequence. Research indicates that the best way to teach measure is to provide many opportunities for the students to measure, then use their results to solve problems. This could be a viable approach to providing practice in data collection, measurement, and problem solving—three major areas where test measures indicate a need for reinforcement.

Prediction (probability) - The performance of seventh graders in this area is well below grade expectancies. The scope and sequence suggests that seventh graders are expected to solve probability of paired events problems. In solving such a problem, one must consider the following factors:

- sample space
- elements
- sample points
- dependent or independent events
- exclusivity of events
- ability to retrieve from memory the correct formula

This area also includes permutations and combinations as subskills. A re-evaluation of the grade level at which mastery of this complex skills is expected might be in order.

FINDINGS

Grade 11

Based on student performance 35% of DoDDS eleventh grade students are 1/2 S.D. or more above the mean (574). This represents a skill range of 600-674. Students within this range are demonstrating a performance level above the national mean for eleventh graders.

Scores within this difficulty range fall within the "optimal" range of development for most mathematics subskills. It is inferred that subskills which have difficulty levels falling within or below the range of the mean are within the mathematics capabilities of this 35% of the DoDDS eleventh grade student population.

As presented in Figure 3, the following mathematics subskills have an upper range of difficulty above 600, and represent a high performance level in relation to the DoDDS mean (574). Students whose performance is at or below the mean will have difficulty with these skill areas, especially at their upper difficulty levels.

Number Awareness
exponents, coordinates

Computation
multiplication of fractions
division of decimals
fraction to decimal

Problem Solving
tables, graphs, charts
geometric formulas
multi-step word problems

Data Collection
mean, median, mode, range

Measure
cubic

Predictions
probability, odds

Geometry
relationships between figures

More than one-third (34%) of the DoDDS eleventh grade students scored within a range of 549-599, 1/2 S.D. on either side of the mean. Students within this score range have demonstrated mathematics performance continguous with normal expectancy, as defined by the DoDDS Scope and Sequence Skill Guide for grade 11. Students within this score range demonstrate competence in the following subskills falling within this range:

Number Awareness
order, equality, place value, exponents, coordinates

Computation
addition of fractions
addition of decimals
subtraction of fractions
subtraction of decimals
multiplication of whole numbers
multiplication of fractions
division of whole numbers
division of fractions
division of decimals
fraction to percent
fraction to decimal
percent to fraction
percent to decimal
decimal to fraction

Problem Solving
tables, graphs, charts
geometric formulas
multi-step word problems

Data Collection
mean, median, mode, range

Measure
linear English
square measure

Predictions
probability

Geometry
classify 2-dimensional forms
relationships between figures

Sets
sets

It is inferred that, where student within 1/2 S.D. of the mean are often still in the process of acquiring complete mastery of these skills, students more than 1/2 S.D. above the mean have more thorough control of them. Similarly, it is to be inferred that students performing at or near the level of the mean have acquired mastery of those skills whose upper level of difficulty is below the point 1/2 S.D. below the mean.

Slightly less than one-third (31%) of the DoDDS eleventh grade students fell into the below-normal expectancy range (scores 272-548). All mathematics subskills are represented in Figure 3, and represent an appropriate instructional range of difficulty for eleventh grade students in this performance category. Skills outside the ability range of this group would include square measure, cubic measure, and the upper range of the following subskills:

Number Awareness
order, equality, place value, exponents, coordinates

Computation
addition of fractions
addition of decimals
subtraction of fractions
subtraction of decimals
multiplication of whole numbers
multiplication of fractions
division of whole numbers
division of fractions
division of decimals
fraction to percent
fraction to decimal
percent to fraction
percent to decimal
decimal to fraction

Problem Solving
tables, graphs, charts
geometric formulas
multi-step word problems

Data Collection
mean, median, mode, range

Measure
linear English

Predictions
probability

Geometry
classify 2 dimensional forms
relationships between figures

Sets
sets

As was mentioned in the seventh grade summary, the individual student's score must be the determining factor for the remediation to be implemented.

CURRICULAR IMPLICATIONS AND RECOMMENDATIONS

Number Awareness - excellent skill development. Those students who comprise the upper 34% could be doing intensive number theory investigations.

Computational Skills - A high level of proficiency has been reached for 69% of the students. Those whose scores lie in the range of 272 to 548 are in need of remediation in specific areas which can be determined by use of the individual student report.

Problem Solving - In this area the greatest disparity occurs between grade level expectancies (as expressed in DoDDS Scope and Sequence) and student performance. Simple one-step problems are solved, but those which involve several different operations to achieve an answer are in need of greater curricular emphasis. An example of this type is:

Almonds sell for $2.70 per pound and cashews sell for $4.50 per pound. How many pounds of each should be mixed to produce a 40-pound mixture that sells for $3.33 per pound?

Measurement - The subskill area in which 11th graders seem to have need of additional classroom emphasis is cubic measure. The areas of linear and square measure show high levels of performance.

Probability - Performance in this area would indicate need for increased curricular emphasis on problems of this type:

A bag contains the following coins: a half dollar, a quarter, a dime, a nickel, and a penny. Suppose one coin is selected at random. What is the probability that the coin is worth at least ten cents?

SUMMARY

MATHEMATICS

DoDDs seventh and eleventh grade performance in mathematics was above the national means (510 and 570 respectively.)

With a seventh grade mean of 510, 54% of DoDDS students at this grade level demonstrated competence in mathematics within a normal expectancy range contiguous with DoDDS Scope and Sequence Curricular Skills Guide. Approximately 34% of DoDDS eleventh grade students demonstrated mathematics skills within a normal expectancy range (1 S.D. around the mean).

Findings showed that 16% the DoDDS seventh grade students and 35% of the eleventh grade students have demonstrated mathematics skills above normal expectancy. Student performance at both grade levels evidence strong competency in basic computational skills. Operations with integer in the processes of addition, substraction, multiplication and division show a strong instructional program and high retention level. With strengths in one-step application of computational skills, there is a carryover from direct computation to solving problems involving one mode.

Performance below normal expectancy was represented by a score range of 418-507 with 29% of the DoDDS seventh grade students in this performance category. Approximately 31% of the DoDDS eleventh grade students fell below normal expectancy (score ranges of 428-548). All mathematics subskills would need instructional emphasis to develop foundation skills for practical use or prerequisites to higher mathematics coursework. Individual evaluation or student performance in computational skills is recommended prior to prescriptive remedial instuction.

Curricular Implications

Appropriate instructional emphasis should be given to the area of applications. Conversions to decimals, temperature, measurement, and time were difficult items for DoDDS students. Although research generally shows that performance on application skills in most schools in the United States falls below that of operations, for college-bound students increased emphasis in the curriculum in applications is very important.

Other skill areas in need of instructional emphasis were operations involving unlike fractions with unlike denominators; also, the solving of problems involving more than one mode (two-step problems), such as working with averages, which requires a two-step solution involving addition and division.

In order to maximize the two-step problem-solving process, real life situations or life skill applications are essential. This would involve such activities as: linear measurement as applied to carpentry, averaging baseball scores, following the stock market reports, calculating credit/installment purchases, determining discounts and percentages, working with banking rates, and such things as cooking measurements. Many schools are finding that an interdisciplinary approach involving mathematics as a life application increases student performance in application skills. Courses might include home economics, industrial arts, physical education, social studies, and health education.

APPENDICES

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN READING, GRADE 9

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1**	322	4.4	6531*	90.5	176	2.4	100	1.3
2	202	2.8	53	0.7	6832*	94.7	120	1.6
3	6981*	96.8	115	1.5	76	1.0	36	0.4
4	65	0.9	6617*	91.7	252	3.4	266	3.6
5	6502*	90.1	493	6.8	121	1.6	69	0.9
6	2050	28.4	333	4.6	4713*	65.3	106	1.4
7	283	3.9	245	3.3	6358*	88.1	319	4.4
8	224	3.1	390	5.4	5899*	81.8	690	9.5
9	1429	19.8	5303*	73.5	421	5.8	33	0.4
10	1983	27.5	413	5.7	4694*	65.1	87	1.2
11	5211*	72.2	359	4.9	847	11.7	783	10.8
12	175	2.4	6023*	83.5	663	9.1	341	4.7
13	728	10.0	241	3.3	5827*	80.8	406	5.6
14	4080*	56.5	540	7.4	2325	32.2	250	3.4
15	445	6.1	845	11.7	2852	39.5	3048*	42.2
16	1174	16.2	5324*	73.8	339	4.7	348	4.8
17	672	9.3	302	4.1	309	4.2	5904*	81.8
18**	2129	29.5	4296*	59.5	335	4.6	403	5.5
19	183	2.5	6340*	87.9	166	2.3	489	6.7
20**	3094*	42.9	2943	40.8	279	3.8	836	11.5
21	844	11.7	500	6.9	469	6.5	5341*	74.0
22	517	7.1	227	3.1	4300*	59.6	2042	28.3

* Indicates correct choice
** Indicates deleted item

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN READING, GRADE 11

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	3460*	97.0	70	1.0	33	0.9	4	0.1
2	34	.95	47	1.0	3421*	95.9	64	1.7
3	82	2.2	137	3.8	3233*	90.6	98	2.7
4	308	8.6	2773*	77.7	192	5.3	248	7.9
5	227	6.3	107	3.0	3198*	89.6	29	0.8
6	3298*	92.4	95	2.6	144	4.0	20	0.6
7	3385*	94.8	128	3.5	49	1.3	3	0.0
8**	338	9.4	17	0.4	3165*	88.7	45	1.2
9**	315	8.8	79	2.2	2942*	82.4	229	6.4
10	416	11.6	3033*	85.0	60	1.6	53	1.4
11	230	6.4	91	2.5	2767*	77.5	476	13.3
12	74	2.0	152	4.2	3212*	90.0	125	3.5
13	157	4.4	2137*	59.9	740	20.7	529	14.8
14	173	4.8	2425*	67.9	801	22.4	161	4.5
15	198	5.5	489	13.7	2712*	76.0	158	4.4
16	67	1.8	2346*	65.7	194	5.4	947	26.5
17**	1001	28.0	1981*	55.5	548	15.3	15	0.4

* Indicates correct choice
** Indicates deleted item

APPENDIX 1

ITEM ANALYSIS

ITEM ANALYSIS FOR BASIC SKILLS
ASSSESSMENT TEST IN LANGUAGE ARTS, GRADE 9

ITEM POSITION NUMBER	ITEM OPTIONS							
	A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	211	2.9	6857*	96.1	44	0.6	19	0.2
2	746	10.4	42	0.5	6326*	88.6	13	0.1
3	168	2.3	237	3.3	6339*	88.8	375	5.2
4	260	3.6	312	4.3	6517*	91.3	33	0.4
5	354	4.9	471	6.6	6203*	86.9	101	1.4
6	194	2.7	55	0.7	6757*	94.7	124	1.7
7	139	1.9	6215*	87.1	555	7.7	193	2.7
8	995	13.9	774	10.8	4700*	65.8	639	8.9
9	205	2.8	158	2.2	86	1.2	6668*	93.4
10	1270	17.8	204	2.8	62	0.8	5578*	78.1
11	1150	16.1	5845*	81.9	116	1.6	19	0.2
12	276	3.8	397	5.5	5742*	80.4	711	9.9
13	581	8.1	5698*	79.8	486	6.8	264	3.7
14	118	1.6	6545*	91.7	161	2.2	296	4.1
15	835	11.7	436	6.1	4199*	58.8	1649	23.1
16	851	11.9	134	1.8	295	4.1	5844*	81.9
17	2301*	32.2	3030	42.4	372	5.2	1415	19.8
18	555	7.7	706	9.8	558	7.8	5298*	74.2
19	874	12.2	5549*	77.7	172	2.4	527	7.3
20	391	5.4	4121*	57.7	779	10.9	1815	25.4
21	2445	34.2	1755	24.6	1965*	27.5	953	13.3
22	4232*	59.3	313	4.3	1832	25.6	726	10.1
23	1449	20.3	1697	23.7	3913*	54.8	35	0.4

ITEM ANALYSIS FOR BASIC SKILLS
ASSSESSMENT TEST IN LANGUAGE ARTS, GRADE 9

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
24	2107	29.5	3489*	48.9	730	10.2	781	10.9
25	504	7.1	343	4.8	5867*	82.4	394	5.5
26	4495	63.0	1800*	25.2	774	10.8	36	0.5
27**	1456	20.4	3964	55.5	1640*	22.9	28	0.3
28	1565	21.9	2908	40.7	2559*	35.8	43	0.6
29	2933*	41.1	2400	33.6	1615	22.6	46	0.

* Indicates correct choice
** Indicates deleted item

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN LANGUAGE ARTS FOR GRADE 11

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	38	1.0	30	0.8	40	1.1	3469*	96.9
2	146	4.0	270	7.5	3070*	85.8	87	2.4
3	198	5.5	154	4.3	3189*	89.1	36	1.0
4	690	19.2	64	1.7	2782*	77.7	40	1.1
5	3277	91.5	79	2.2	146	4.0	69	1.9
6	3283	91.7	73	2.0	115	3.2	99	2.7
7	70	1.9	2685*	75.0	49	1.3	772	21.5
8	417	11.6	104	2.9	2832*	79.1	220	6.1
9	625	17.4	54	1.5	2784*	77.8	113	3.1
10	819	22.8	743	20.7	1823*	50.9	188	5.2
11	1072	29.9	2466*	68.9	36	1.0	2	0.0
12	3356*	93.7	44	1.2	88	2.4	88	2.4
13**	505	14.1	1395	38.9	1651*	46.1	17	0.4
14	1487*	41.5	1955	54.6	77	2.1	51	1.4
15	2674*	74.7	198	5.5	322	8.9	364	10.1
16	523	14.6	2345*	65.5	693	19.3	11	0.3
17	52	1.4	60	1.6	134	3.7	3328*	93.0
18	239	6.6	785	21.9	2338*	65.3	200	5.5
19	2449*	68.4	1070	29.9	44	1.2	10	0.2
20	147	4.1	1658*	46.3	337	9.4	1434	40.0
21	190	5.3	2013*	56.2	1334	37.2	37	1.0
22	649	18.1	1596*	44.6	718	20.0	599	16.7
23	3160*	88.3	66	1.8	243	6.7	75	2.0

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN LANGUAGE ARTS FOR GRADE 11

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
24	1311	36.6	1464*	40.9	736	20.5	25	0.6
25	1030	28.7	1585*	44.2	380	10.6	544	15.2
26	1776*	49.6	1334	37.2	402	11.2	17	0.4
27	1095	30.6	781	21.8	724	20.2	907*	25.3

*Indicates correct choice
**Indicates deleted item

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN MATHEMATICS, GRADES COMBINED

ITEM POSITIONS NUMBER	ITEM OPTIONS							
	A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	875	7.2	8	0.1	28	0.2	11237*	92.5
2	48	0.4	11973*	98.6	68	0.6	53	0.4
3**	130	1.1	693	5.7	740	6.1	10563*	86.9
4**	11786*	97.0	186	1.5	110	0.9	62	0.5
5	54	0.4	11324*	93.2	383	3.2	371	3.1
6	29	0.2	148	1.2	105	0.9	11845*	97.
7	256	2.1	192	1.6	11178*	92.0	503	4.1
8	10548*	86.8	329	2.7	183	1.5	1053	8.7
9	157	1.3	10710*	88.2	394	3.2	859	7.1
10	431	3.5	407	3.4	11170*	91.9	119	1.0
11	46	0.4	108	0.9	279	2.3	11671*	96.1
12	572	4.7	449	3.7	10549*	86.8	537	4.4
13	93	0.8	10798*	88.9	206	1.7	1037	8.5
14	11560*	95.2	170	1.4	142	1.2	266	2.2
15	169	1.4	435	3.6	11159*	91.9	316	2.6
16	854	7.0	364	3.0	10669*	87.8	172	1.4
17	10359*	85.3	600	4.9	475	3.9	542	4.5
18	250	2.1	1214	10.0	467	3.8	10109*	83.2
19	277	2.3	306	2.5	221	1.8	11284*	92.9
20	11133	91.6	313	2.6	320	2.6	227	1.9
21	842	6.9	566	4.7	1377	11.3	9166*	75.4
22	877	7.2	251	2.1	5669	46.7	5198*	42.8
23	1104	9.1	3747	30.8	4835*	39.8	2095	17.2

ITEM ANALYSIS FOR BASIC SKILLS
ASSESSMENT TEST IN MATHEMATICS, GRADES COMBINED

ITEM POSITIONS NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
24	1062	8.7	924	7.6	9177*	75.5	488	3.7
25	231	1.9	7816*	64.3	359	3.0	3591	29.6
26	2365	19.5	1905	15.7	2479	20.4	4968*	40.9
27	3063*	25.2	1166	9.6	3332	27.4	4225	34.8
28	3604*	29.7	5412	44.5	1415	11.6	1309	10.8
29	871	7.2	7808*	64.3	1014	8.3	2022	16.
30	3234	26.6	593	4.9	5771*	47.5	2262	18.6
31	2365	19.5	803	6.6	441	3.6	8236*	67.8
32	1274	10.5	7683*	63.2	790	6.5	1981	16.3
33	308	2.5	7395*	60.9	1507	12.4	2491	20.5
34	2202	18.1	1393	11.5	6484*	53.4	1498	12.3
35	7018	57.8	2094	17.2	1083	8.9	1256	10.3
36	334	2.7	458	3.8	10417*	85.7	360	3.0
37	447	3.7	490	4.0	5080*	41.8	5466	45.0
38	1393	11.5	1088	9.0	329	2.7	8685*	71.5
39	8164*	67.2	1253	10.3	936	7.7	924	7.6
40	1383	11.4	6598	54.3	675	5.6	2643*	21.8

*Indicates correct choice
**Indicates delet item

ITEM ANALYSIS FOR THE BASIC SKILLS
ASSESSMENT TEST, MATHEMATICS, GRADE 7

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	571	7.5	6	0.1	19	0.2	7045*	92.2
2	33	0.4	7523*	98.5	41	0.5	37	0.5
3**	95	1.2	438	5.7	426	5.6	6662*	87.2
4**	7376*	96.5	135	1.8	80	1.0	45	0.6
5	46	0.6	7055*	92.3	252	3.3	276	3.6
6	21	0.3	122	1.6	82	1.1	7398*	96.8
7	197	2.6	135	1.8	6962*	91.1	328	4.3
8	6493*	85.0	235	3.1	148	1.9	733	9.6
9	109	1.4	6661*	87.2	268	3.5	585	7.7
10	279	3.7	314	4.1	6932*	90.7	96	1.3
11	33	0.4	87	1.1	207	2.7	7277*	95.2
12	386	5.1	344	4.5	6492*	85.0	386	5.1
13	74	1.0	6641*	86.9	164	2.1	749	9.8
14	7192*	94.1	137	1.8	120	1.6	181	2.4
15	134	1.8	322	4.2	6901*	90.3	221	2.9
16	511	6.7	277	3.6	6662*	87.2	117	1.5
17	6211*	81.3	489	6.4	396	5.2	395	5.2
18	203	2.7	1016	13.3	358	4.7	5964*	78.1
19	218	2.9	264	3.5	171	2.2	6937*	90.8
20	6899*	90.3	215	2.8	239	3.1	156	2.0
21	725	9.5	467	6.1	949	12.4	5324*	69.7
22	617	8.1	187	2.4	4256	55.6	2462*	32.2
23	793	10.4	2474	32.4	2565*	33.6	1503	19.7

ITEM ANALYSIS FOR THE BASIC SKILLS
ASSESSMENT TEST, MATHEMATICS, GRADE 7

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
24	779	10.2	692	9.1	5362*	70.2	347	4.5
25	187	2.4	4341*	56.8	285	3.7	2691	35.2
26	1737	22.7	1454	19.0	1785	23.4	2278*	29.8
27	1413*	18.5	796	10.4	2177	28.5	2936	38.4
28	1394*	18.2	4218	55.2	948	12.4	726	9.5
29	667	8.7	4261*	55.8	854	11.2	1486	19.4
30	2195	28.7	385	5.0	3233*	42.3	1569	20.5
31	1808	23.7	618	8.1	360	4.7	4584*	60.0
32	935	12.2	4167*	54.5	576	7.5	1595	20.9
33	228	3.0	3799*	49.7	1160	15.2	2059	26.9
34	1697	22.2	991	13.0	3432*	44.9	1018	13.3
35	3882*	50.8	1489	19.5	792	10.4	876	11.5
36	253	3.3	376	4.9	6236*	81.6	274	3.6
37	383	5.0	397	5.2	2756*	36.1	3520	46.1
38	1088	14.2	908	11.9	279	3.7	4796*	62.8
39	4524*	59.2	1017	13.3	753	9.9	648	8.5
40	877	11.5	4379	57.3	444	5.8	1298*	17.0

*Indicates correct choice
**Indicates deleted item

ITEM ANALYSIS FOR THE BASIC SKILLS
ASSESSMENT TEST, MATHEMATICS, GRADE 11

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
1	304	6.7	2	0.0	9	0.2	4192*	93.0
2	15	0.3	4450*	98.7	27	0.6	16	0.3
3**	35	0.8	255	5.7	314	7.0	3901*	86.6
4**	4410*	97.8	51	1.1	30	0.7	17	0.4
5	8	0.2	4269*	94.8	130	2.9	95	2.1
6	8	0.2	26	0.6	23	0.5	4447*	98.8
7	59	1.3	57	1.3	4216*	93.6	175	3.9
8	4055*	90.0	94	2.1	35	0.8	320	7.1
9	48	1.1	4049*	90.0	126	2.8	274	6.1
10	152	3.4	93	2.1	4238*	94.1	23	0.5
11	13	0.3	21	0.5	72	1.6	4394*	97.6
12	186	4.1	105	2.3	4057*	90.2	151	3.4
13	80	1.8	4157*	91.0	42	0.9	288	6.3
14	4368*	96.9	33	0.7	22	0.5	85	1.9
15	35	0.8	113	2.5	4258*	94.6	95	2.1
16	343	7.6	87	1.9	4007*	89.2	55	1.2
17	4148*	92.5	111*	2.5	79	1.8	147	3.3
18	47	1.0	198	4.4	109	2.4	4145*	92.1
19	59	1.3	42	0.9	50	1.1	4347*	96.6
20	4234*	94.4	98	2.2	81	1.8	71	1.6
21	117	2.6	99	2.2	428	9.5	3842*	85.6
22	260	5.8	64	1.4	1413	31.6	2736*	61.2
23	311	7.0	1273	28.6	2270*	51.1	592	13.3

ITEM ANALYSIS FOR THE BASIC SKILLS
ASSESSMENT TEST, MATHEMATICS, GRADE 11

ITEM POSITION NUMBER	ITEM OPTIONS A FREQUENCY	%	B FREQUENCY	%	C FREQUENCY	%	D FREQUENCY	%
24	283	6.4	232	5.2	3815*	86.1	101	2.3
25	44	1.0	3475*	77.3	74	1.6	900	20.0
26	628	14.1	451	10.1	694	15.6	2690*	60.3
27	1650*	37.0	370	8.3	1155	25.9	1289	28.9
28	2210*	49.6	1194	26.8	467	10.5	583	13.1
29	204	4.6	3547*	79.7	162	3.6	536	12.0
30	1039	23.3	208	4.7	2538*	57.0	666	15.0
31	557	12.4	185	4.1	81	1.8	3652*	81.6
32	339	7.6	3516*	78.9	214	4.8	386	8.7
33	80	1.8	3596*	80.7	347	7.8	432	9.7
34	505	11.4	402	9.0	3052*	68.8	480	10.8
35	3136*	71.0	605	13.7	291	6.6	380	8.6
36	81	1.8	82	1.9	4181*	94.4	86	1.9
37	64	1.4	93	2.1	2324*	52.5	1946	44.0
38	305	6.9	180	4.1	50	1.1	3889	87.9
39	3640*	84.0	236	5.4	183	4.2	276	6.4
40	506	11.8	2219	51.6	232	5.4	1345*	31.3

*Indicates correct choice
**Indicates deleted item

APPENDIX 2

CUMULATIVE FREQUENCIES

BASIC SKILLS ASSESSMENT TEST IN READING

GRADE 9

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
396	2	2	.03
431	3	5	.08
453	10	15	.23
471	13	28	.43
486	32	60	.93
499	55	115	1.78
511	70	185	2.87
522	96	281	4.36
533	139	420	6.51
544	223	643	9.97
554	290	933	14.45
566	463	1,396	21.65
577	635	2,031	31.50
590	868	2,899	44.96
605	1,070	3,969	61.55
622	1,169	5,138	79.68
644	858	5,996	92.99
679	452	6,448	100.00

BASIC SKILLS ASSESSMENT TEST IN READING

GRADE 11

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
410	3	3	.09
446	3	6	.17
470	7	13	.38
490	24	37	1.08
507	58	95	2.76
523	44	139	4.04
539	72	211	6.13
555	105	316	9.18
571	207	523	15.20
589	354	877	25.49
610	531	1,408	40.92
635	733	2,141	62.22
672	1,300	3,441	100.00

BASIC SKILLS ASSESSMENT TEST IN LANGUAGE ARTS

GRADE 9

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
356	2	2	.03
390	1	3	.05
411	1	4	.06
428	1	5	.08
441	0	5	.08
453	11	18	.28
464	10	28	.44
473	13	41	.64
483	22	63	.99
491	41	104	1.63
500	69	173	2.71
508	81	254	3.98
516	117	371	5.82
524	205	576	9.04
533	237	813	12.75
541	349	1,162	18.23
550	386	1,548	24.28
558	640	2,188	34.32
568	730	2,918	45.77
577	700	3,618	56.75
588	712	4,330	67.92
599	655	4,985	78.20
611	556	5,541	86.92
625	382	5,923	92.91
643	251	6,174	96.85
665	137	6,311	98.99
700	64	6,375	100.00

BASIC SKILLS ASSESSMENT TEST IN LANGUAGE ARTS

GRADE 11

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
433	13	15	.41
451	20	35	.95
466	66	101	2.73
478	99	200	5.40
490	24	224	6.05
501	26	250	6.75
511	25	275	7.42
520	57	332	8.96
530	64	396	10.69
539	110	506	13.66
548	158	664	17.93
557	181	845	22.81
566	228	1,073	28.97
575	308	1,381	37.28
584	357	1,738	46.92
594	365	2,103	56.78
604	340	2,443	65.96
615	320	2,763	74.59
627	303	3,066	82.78
641	253	3,319	89.60
658	202	3,521	95.06
680	118	3,639	98.25
715	65	3,704	100.00

BASIC SKILLS ASSESSMENT TEST IN MATHEMATICS

GRADE 7

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
353	1	1	.01
367	3	4	.05
380	2	6	.08
391	10	16	.21
401	9	25	.33
410	17	42	.55
418	27	69	.90
426	35	104	1.36
434	52	156	2.04
441	56	212	2.77
448	66	278	3.63
455	102	380	4.96
462	106	486	6.34
468	138	624	8.15
475	216	840	10.96
482	263	1,103	14.40
488	354	1,457	19.02
495	358	1,815	23.69
501	442	2,257	29.46
508	454	2,711	35.38
515	470	3,181	41.52
522	452	3,633	47.42
529	521	4,154	54.22
537	507	4,661	60.84
544	456	5,117	66.79
553	469	5,586	72.91
561	440	6,026	78.65
570	391	6,417	83.76
580	339	6,756	88.19
590	293	7,049	92.01
602	237	7,286	95.10
615	173	7,459	97.36
630	108	7,567	98.77
649	72	7,639	99.71
674	22	7,661	100.00

BASIC SKILLS ASSESSMENT TEST IN MATHEMATICS

GRADE 11

FREQUENCY (f), CUMULATIVE FREQUENCY (cf),
AND CUMULATIVE PERCENTAGE (cum %)

MEASURE ON SCALE	f	cf	cum %
272	2	2	.05
401	2	4	.09
410	2	6	.14
418	3	9	.21
426	5	14	.32
434	6	20	.46
441	8	28	.65
448	7	35	.81
455	17	52	1.20
462	15	67	1.55
468	19	86	2.00
475	25	111	2.57
482	39	150	3.47
488	45	195	4.51
495	81	276	6.39
501	70	346	8.01
508	104	450	10.42
515	116	566	13.10
522	151	717	16.60
529	175	892	20.66
537	187	1,079	24.99
544	253	1,332	30.85
553	231	1,563	36.20
561	275	1,838	42.57
570	308	2,146	49.70
580	344	2,490	57.67
590	320	2,810	65.08
602	389	3,199	74.09
615	348	3,547	82.14
630	338	3,885	89.97
649	295	4,180	96.80
674	138	4,318	100.00

APPENDIX 3

NATIONAL MEANS

NATIONAL MEANS*

READING COMPREHENSION

GRADE LEVEL	AVERAGE	STANDARD DEVIATION	NUMBER
3	467	56.8	330
4	481	59.1	3,584
5	506	63.5	9,438
6	535	65.6	5,243
7	540	66.0	7,321
8	572	64.8	4,571
9	576	62.0	5,971
10	591	60.9	8,669
11	604	72.8	1,899
12	612	73.6	919

*National means were based on a calibration sample of 60,000 students across grade levels 3-12. Samples were drawn from five states representing various geographic regions across the United States.

NATIONAL MEANS*

WRITTEN EXPRESSION

GRADE LEVEL	AVERAGE	STANDARD DEVIATION	NUMBER
3	443	56.6	326
4	458	66.1	3,691
5	489	77.0	8,993
6	520	85.4	4,937
7	528	94.1	7,041
8	548	49.3	4,191
9	555	96.8	5,636
10	566	167.8	8,475
11	574	215.2	1,815
12	566	155.6	890

*National means were based on a calibration sample of 60,000 students across grade levels 3-12. Samples were drawn from five states representing various geographic regions across the United States.

NATIONAL MEANS*

MATHEMATICS

GRADE LEVEL	AVERAGE	STANDARD DEVIATION	NUMBER
3	377	58.5	329
4	421	58.9	3,642
5	462	48.2	9,028
6	493	52.6	4,919
7	510	58.7	6,903
8	535	57.9	4,340
9	546	59.9	5,841
10	563	60.0	7,791
11	570	64.1	1,657
12	569	67.4	932

*National means were based on a calibration sample of 60,000 students across grade levels 3-12. Samples were drawn from five states representing various geographic regions across the United States

APPENDIX 4

DEMOGRAPHIC DATA

SUMMARY OF RESPONSES TO
LANGUAGE, ATTENDANCE, AND REMEDIATION QUESTIONS ON ANSWER SHEET

"Before you started school, what language(s) did you speak most often at home?"

	English Only		Other Language		English and another		I don't know	
	Freq.	Cum %	Freq.	Cum %	Freq.	Cum %	Freq.	Cum %
MATHEMATICS								
Atlantic	245	66.9	18	4.9	38	10.4	5	1.4
European	6951	70.1	634	6.4	1732	17.5	82	.8
Pacific	1278	69.8	153	8.4	340	18.6	13	.7
Overall	8474	69.9	805	6.6	2110	17.4	100	.8
LANGUAGE ARTS								
Atlantic	208	74.6	13	4.7	24	8.6	2	.7
European	5874	65.9	596	6.7	1448	16.3	49	.6
Pacific	1041	69.6	116	7.8	287	19.2	18	1.2
Overall	7123	66.7	725	6.8	1759	16.5	69	.7
READING								
Atlantic	290	79.2	17	4.6	32	8.7	1	.3
European	6124	68.5	618	6.9	1467	16.4	50	.6
Pacific	1030	69.8	107	7.3	280	18.9	14	.9
Overall	7444	69.1	742	6.9	1779	16.5	65	.6

"Altogether, how long have you attended the Overseas Dependents Schools?"

	Less than one year		One to two years		Greater than three years		I don't know	
	Freq.	Cum %	Freq.	Cum %	Freq.	Cum %	Freq.	Cum %
MATHEMATICS								
Atlantic	59	16.1	85	23.2	144	39.3	3	.8
European	1385	13.9	2504	25.3	5177	52.2	11	.1
Pacific	312	17.0	487	26.6	928	50.7	1	.1
Overall	1756	14.5	3076	25.4	6249	51.6	15	.1
LANGUAGE ARTS								
Atlantic	43	15.4	84	30.1	118	42.3	0	0
European	1097	12.3	1973	22.1	4757	53.4	0	0
Pacific	259	17.3	389	26.0	779	52.1	0	0
Overall	1399	13.1	2446	22.9	5654	52.9	0	0
READING								
Atlantic	59	16.1	110	30.1	171	46.7	0	0
European	1161	12.9	2048	22.9	4906	54.9	2	0
Pacific	253	17.2	381	25.8	766	51.9	0	0
Overall	1473	13.7	2539	23.6	5843	54.2	2	0

"Is English the language spoken most often in your home now?"

	Yes		No		I don't know	
	Freq.	Cum %	Freq.	Cum. %	Freq.	Cum %
MATHEMATICS						
Atlantic	0	0	359	98.1	7	1.9
European	0	0	9772	98.5	146	1.5
Pacific	0	0	1792	97.9	39	2.1
Overall	0	0	11923	98.4	192	1.6
LANGUAGE ARTS						
Atlantic	233	83.5	44	15.8	2	.7
European	7293	81.8	1525	17.11	95	1.1
Pacific	1307	87.4	164	10.9	24	1.6
Overall	8833	82.7	1733	16.2	121	1.1
READING						
Atlantic	322	87.9	42	11.5	2	.5
European	7551	84.5	1295	14.5	93	1.0
Pacific	1282	86.9	170	11.5	23	1.6
Overall	9155	84.9	1507	13.9	118	1.1

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BASIC SKILLS ASSESSMENT TEST

EXECUTIVE SUMMARY

SPRING 1979

TM800 205 2of2

Office of Dependents Schools

EXECUTIVE SUMMARY

INTRODUCTION

Described herein are the underlying principles of the Department of Defense Dependents Schools (DoDDS) basic testing program conducted during the fiscal year 1978-79. Described are (1) the procedures used in developing the tests, (2) the statistical characteristics of the tests, (3) the methods employed in analyzing the findings, and (4) the curricular implications and recommendations based on these analyses.

This document has been prepared for educators in the school system to serve as a basis for school-level curricular review and development. The achievement test results reported herein should serve to focus school personnel on student achievement in relation to existing basic skills programs. Out of a review of this document and its findings should grow new instructional strategies to strengthen the achievement of DoDDS students within the basic skills in reading, language, and mathematics.

RATIONALE FOR USING THE RASCH MODEL

Historically, traditional group testing procedures have offered incomplete solutions to the complex measurement problems associated with achievement assessment. In the past, the interpretation of a student's score has been dependent upon some external reference group, or dependent upon a unique set of items--or both. Standardized, or norm-referenced instruments, allow each item to contribute equally to the total score, even if the items are matched to specific objectives. Such instruments offer no provision for the assessment of skills of varying difficulty and importance. Only the absolute number of correct responses affect the total score and its subsequent interpretation.

Criterion-referenced tests with specific items matched to skills or objectives did not solve these complex measurement problems. The question of the differential importance of skills and the identification of mastery, both within and across skills, for a content area remained unanswered. The criterion reference approach to testing did not solve the problem of a resulting test score being dependent upon a unique set of items for interpretation.

The educational community needed a measurement system that (1) provides an assessment of a student's ability interpretable without reference to a specific group of students or a unique set of items and (2) allows those skills assessed to be arranged in an empirically based hierarchical continuum of difficulty.

The basis for the development of such a measurement system has been found in the Rasch model. This statistical model states that it is possible to calibrate or scale a collection of items measuring various skills within a content area into a hierarchical continuum of difficulty which remains constant across various sub-groups of examinees and subsets of items. Further, the model provides for item-banking which results in a person-free, item-free approach to skills assessment. The interpretation of an

the calibrated item bank is referenced to the specific skills being measured—not to the performance of an external group. This achievement level also provides for the identification of mastery with respect to all skills assessed by items in the bank within defined probability limits. Under this scaling procedure, the achievement level indicated by one subset of items is the same as the achievement level indicated by a different subset of items. Contained within this system is also the ability to provide normative data with respect to any identifiable group or sub-group of examinees.

SCOPE OF RESPONSIBLITY

The DoDDS Basic Testing Program utilized the services of the Los Angeles County Test Development Center (TDC) in order to institute the use of the Rasch measurement model. Tests were developed for DoDDS students in the subject areas of reading and language arts in grades 9 and 11 and for grades 7 and 11 in mathematics.

DEVELOPMENT OF THE DoDDS TEST

During the winter of 1978-79, personnel of the TDC worked with measurement and curriculum personnel of DoDDS to select domains within each of the basic skill content areas to be tested. The process included the identification of major skill and subskill areas deemed pertinent by DoDDS as defined by defense schools curriculum guides.

Members of the TDC staff selected appropriate test items to form a pool of items from which the DoDDS staff could make the final selection. Members of DoDDS curriculum staff made the final item selections in January, 1979. There were two separate forms constructed for reading and language arts in grades 9 and 11 and one form was constructed for mathematics in grades 7 and 11.

TEST ADMINISTRATION AND DISTRIBUTION OF MATERIALS

Test materials (including test booklets, answer sheets, and manuals) were mailed to 260 school sites in the Atlantic, European, and Pacific regions. Students selected by the Department of Defense schools were tested in grades 7 (mathematics only), 9 (reading and language arts) and 11 (reading, language arts, and mathematics).

DoDDS TESTING PROGRAM REPORTS

After the student answer sheets were scanned and scored, the results were formulated into reports and returned to school sites and the program evaluation staff. The reports sent to each school site included:

1. An individual student report for each subject tested.
2. Student rosters for each subject area.
3. School average score for each subject and grade tested.

Also, a cassette tape/filmstrip program explaining the Rasch Model used for the Basic Skills Assessment tests and an interpretation of the student reports and Skills Continua was developed for inservice use at each school site.

ANALYSIS OF FINDINGS AND CURRICULAR IMPLICATIONS

Test results from the Spring, 1979 testing program were examined by use of the Rasch statistical model combined with a traditional item analysis. Combined grade level data were examined within each content area. Student performance was examined in terms of group percentages and standard deviations around the mean. In order to analyze student performance in relation to a total curricular sequence, the DoDDS Scope and Sequence Curricular Skills Guide was placed on the Rasch measurement scale. In this way, three separate basic skills continua were constructed to analyze score ranges in relation to skill difficulty and instructional sequence. Mean scores for DoDDS students along with national means for corresponding grade levels were placed on each continuum.

Achievement data were grouped into three categories on the basis of standard deviations in relation to DoDDS grade level means in each content area. The three categories are:

(1) DoDDS Normal Expectancy

Scores within this range represent 1 S.D. around the mean (1/2 S.D. above and 1/2 below). Students scoring within this range of "normal" expectancy are considered to be demonstrating basic skills performance contiguous with grade level expectations as defined by the DoDDS Scope and Sequence Curricular Skills Guide.

(2) Above Normal Expectancy

Scores within this range represent 1/2 S.D. or more above the mean. Performance within this range represents skill development within an optimal range of difficulty, or above normal expectancy levels.

(3) Below Normal Expectancy

Scores within this range represent 1/2 S.D. or more below the mean. Student ability within this score range demonstrates skill performance levels ranging from "marginal" skill competency (1-2 years below expectancy) to "minimal" (3rd grade skill level). Students with a score within this range must be evaluated on an individual basis and appropriate remediation should follow.

A summary of the findings and the related curricular implications and recommendations are presented by content areas as follows.

READING

Overall performance in reading was above the national average for both 9th and 11th graders. With a mean score of 600, the ninth grade DoDDS students exceeded a national mean of 576 by a respectable margin. DoDDS eleventh graders achieved a mean score of 626, exceeding a national eleventh grade mean of 604 in reading comprehension.

Findings show that approximately 38% of all eleventh grade DoDDS students demonstrated reading performance levels above the mean, while 20 percent of all ninth graders also showed above-average reading skills. Ninth graders with a score within a range of 623-672; and eleventh graders with a score within a range of 650-679 should be counseled for college preparatory coursework.

Approximately 58% of DoDDS ninth grade students and 47% of the eleventh graders demonstrated reading skills within a normal expectancy range (1 S.D. around the mean).

Performance below normal expectancy was represented by a score range of 396-576 for ninth grade and 410-580 for the eleventh grade. Within this performance category, skills in reading comprehension range from "marginal" reading ability (6th-8th grade reading skills) to low levels of literacy (2nd-3rd grade level). Marginal students would benefit most from instructional back-up services in addition to the regular DoDDS curriculum.

A smaller percentage of both ninth and eleventh grade students would benefit most from a modified course of study designed to develop literacy in relation to life skills while at the same time enhancing comprehension of a variety of reading materials. Reading instruction should be available for all content areas for remedial students.

Curricular Implications

DoDDS students show excellent development of comprehension skills from concrete to abstract levels of thinking. The early emphasis on organization of content for study by use of SQ3R technique may be the contributing factor.

Instructional emphasis for grade nine should include advanced instruction in vocabulary development, contextual definitions, figurative language and abstractions. Emphasis on interpretive skills will strengthen critical reading.

Grade eleven students should continue vocabulary development in context, and should work with recognizing bias in various reading materials such as newspaper editorials and journal articles. Preparation for college exams is highly recommended.

Remedial follow-up based on an individual evaluation is highly recommended for students 1/2 S.D. or more below the mean at each grade level. Remedial emphasis at the eleventh grade should build on a strong literal base but focus on interpretive comprehension skills at the application level.

LANGUAGE ARTS

Overall performance of DoDDS ninth and eleventh grade students in language arts was above the national means (565 and 574 respectively).

With a ninth grade mean of 577, 44% of DoDDS ninth grade students and approximately 37% of the eleventh grade students demonstrated language arts skills within a normal expectancy range (1 S.D. around the mean).

Findings showed that 32% of DoDDS ninth grade students and 34% of all DoDDS eleventh graders have demonstrated language skills above normal expectancy levels as specified by DoDDS. Performance below normal expectancy was represented by a score range of 533 or below. Approximately 24% of all ninth graders fell within this performance category. Almost 29% of DoDDS eleventh grade students fell below normal expectancy (scores less than 567).

For students demonstrating below normal expectancy performance, individual skill evaluation is highly recommended. Remedial follow-up based on individual needs should include writing skills (punctuation, capitalization, usage) as they appear within the body of a paragraph or writing sample.

Curricular Implications

The majority of DoDDS students showed strengths in spelling skills considered basic for high school students. For example, words frequently misspelled due to mispronunciation (spelling "demons") presented no problem. Other apparent curricular strengths included subject/verb agreement and related composition skills such as paragraph development. Eleventh grade teachers should capitalize on these foundation skills by planning creative expository writing activities.

Instructional emphasis for grade 9 students should include maintenance lessons and review for capitalization and punctuation. Advanced students are ready for more difficult uses of punctuation, such as the semi-colon to separate independent clauses.

Formal instruction on usage should include appropriate review of grammatical nomenclature.

Sentence structure and writing skills should emphasize writing original sentences which illustrate compounding, coordination and subordination of ideas. A review of grammatical nomenclature is recommended.

Paragraph development skills should continue to increase in complexity. DoDDS students demonstrate excellent foundation skills in related subskill areas.

Grade 11 students should continue to build upon an excellent language foundation. Technical writing and exposure to a variety of expository styles will serve to enhance basic writing skills. Maintenance lessons on advanced punctuation and usage is also recommended. Rigorous course work in writing and grammar should be available after grade 9 for college-bound students.

MATHEMATICS

DoDDs seventh and eleventh grade performance in mathematics was above the national means (510 and 570 respectively.)

With a seventh grade mean of 510, 54% of DoDDS students at this grade level demonstrated competence in mathematics within a normal expectancy range contiguous with DoDDS Scope and Sequence Curricular Skills Guide. Approximately 34% of DoDDS eleventh grade students demonstrated mathematics skills within a normal expectancy range (1 S.D. around the mean).

Findings showed that 16% the DoDDS seventh grade students and 35% of the eleventh grade students have demonstrated mathematics skills above normal expectancy. Student performance at both grade levels evidence strong competency in basic computational skills. Operations with integers in the processes of addition, substraction, multiplication and division show a strong instructional program and high retention level. With strengths in one-step application of computational skills, there is a carryover from direct computation to solving problems involving one mode.

Performance below normal expectancy was represented by a score range of 418-507 with 29% of the DoDDS seventh grade students in this performance category. Approximately 31% of the DoDDS eleventh grade students fell below normal expectancy (score ranges of 428-548). All mathematics subskills would need instructional emphasis to develop foundation skills for practical use or prerequisites to higher mathematics coursework. Individual evaluation or student performance in computational skills is recommended prior to prescriptive remedial instruction.

Curricular Implications

Appropriate instructional emphasis should be given to the area of applications. Conversions to decimals, temperature, measurement, and time were difficult items for DoDDS students. Although research generally shows that performance on application skills in most schools in the United States falls below that of operations, for college-bound students increased emphasis in the curriculum in applications is very important.

Other skill areas in need of instructional emphasis were operations involving unlike fractions with unlike denominators; also, the solving of problems involving more than one mode (two-step problems), such as working with averages, which requires a two-step solution involving addition and division.

In order to maximize the two-step problem-solving process, real life situations or life skill applications are essential. This would involve such activities as: linear measurement as applied to carpentry, averaging baseball scores, following the stock market reports, calculating credit/installment purchases, determining discounts and percentages, working with banking rates, and such things as cooking measurements. Many schools are finding that an interdisciplinary approach involving mathematics as a life application increases student performance in application skills. Courses might include home economics, industrial arts, physical education, social studies, and health education.